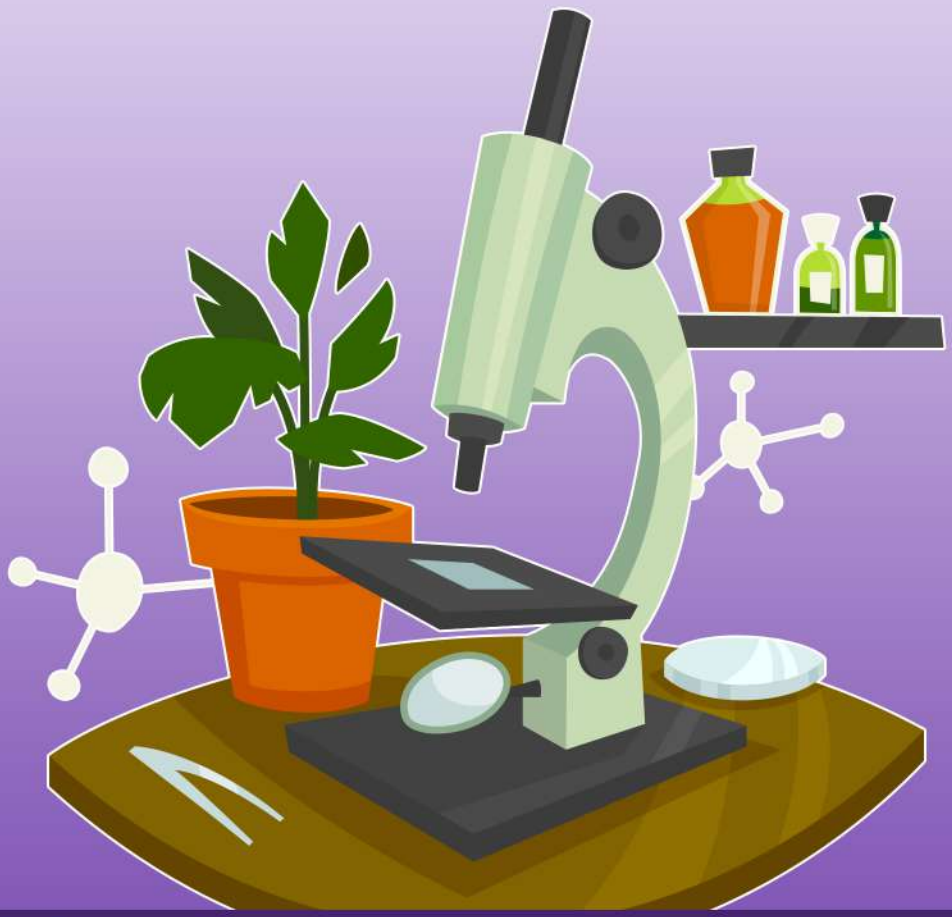
जीव विज्ञान
Biology

कक्षा / Class XI

2025-26

विद्यार्थी सहायक सामग्री
Student Support Material



केन्द्रीय विद्यालय संगठन~Kendriya Vidyalaya Sangathan

संदेश

विद्यालयी शिक्षा में शैक्षिक उत्कृष्टता प्राप्त करना एवं नवाचार द्वारा उच्च - नवीन मानक स्थापित करना केन्द्रीय विद्यालय संगठन की नियमित कार्यप्रणाली का अविभाज्य अंग है। राष्ट्रीय शिक्षा नीति 2020 एवं पी. एम. श्री विद्यालयों के निर्देशों का पालन करते हुए गतिविधि आधारित पठन-पाठन, अनुभवजन्य शिक्षण एवं कौशल विकास को समाहित कर, अपने विद्यालयों को हमने ज्ञान एवं खोज की अद्भुत प्रयोगशाला बना दिया है। माध्यमिक स्तर तक पहुँच कर हमारे विद्यार्थी सैद्धांतिक समझ के साथ-साथ, रचनात्मक, विश्लेषणात्मक एवं आलोचनात्मक चिंतन भी विकसित कर लेते हैं। यही कारण है कि वह बोर्ड कक्षाओं के दौरान विभिन्न प्रकार के मूल्यांकनों के लिए सहजता से तैयार रहते हैं। उनकी इस यात्रा में हमारा सतत योगदान एवं सहयोग आवश्यक है - केन्द्रीय विद्यालय संगठन के पांचों आंचलिक शिक्षा एवं प्रशिक्षण संस्थान द्वारा संकलित यह विद्यार्थी सहायक-सामग्री इसी दिशा में एक आवश्यक कदम है । यह सहायक सामाग्री कक्षा 9 से 12 के विद्यार्थियों के लिए सभी महत्वपूर्ण विषयों पर तैयार की गयी है। केन्द्रीय विद्यालय संगठन की विद्यार्थी सहायक- सामग्री अपनी गुणवत्ता एवं परीक्षा संबंधी सामग्री संकलन की विशेषज्ञता के लिए जानी जाती है और शिक्षा से जुड़े विभिन्न मंचों पर इसकी सराहना होती रही है। मुझे विश्वास है कि यह सहायक सामग्री विद्यार्थियों की सहयोगी बनकर निरंतर मार्गदर्शन करते हुए उन्हें सफलता के लक्ष्य तक पहुँचाएगी।

शुभाकांक्षा सहित ।

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STUDENT SUPPORT MATERIAL

CLASS: XI BIOLOGY

COURSE STRUCTURE
CLASS XI (2025-26)
(THEORY)

Unit	Title	Marks
I	Diversity of Living Organisms	15
II	Structural Organization in Plants and Animals	10
III	Cell: Structure and Function	15
IV	Plant Physiology	12
V	Human Physiology	18
	Total	**70**

UNIT-I DIVERSITY OF LIVING ORGANISMS
Chapter-1: The Living World
Biodiversity; Need for classification; three domains of life; taxonomy and systematics; concept of species and taxonomical hierarchy; binomial nomenclature
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
Classification of plants into major groups; Salient and distinguishing features and a few examples of Algae, Bryophyta, Pteridophyta, Gymnospermae and Angiosperms.
Chapter-4: Animal Kingdom
Salient features and classification of animals, non-chordates up to phyla level and chordates upto class level (salient features and at a few examples of each category).
(No live animals or specimen should be displayed.)

UNIT-II STRUCTURAL ORGANIZATION IN PLANTS AND ANIMALS
Chapter-5: Morphology of Flowering Plants
Morphology of different parts of flowering plants: root, stem, leaf, inflorescence, flower, fruit and seed. Description of family Solanaceae
Chapter-6: Anatomy of Flowering Plants
Anatomy and functions of tissue systems in dicots and monocots.
Chapter-7: Structural Organisation in Animals
Morphology, Anatomy and functions of different systems (digestive, circulatory, respiratory, nervous and reproductive) of frog.

UNIT-III CELL: STRUCTURE AND FUNCTION
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.
Chapter-9: Biomolecules
Chemical constituents of living cells: biomolecules, structure and function of proteins, carbohydrates, lipids, and nucleic acids; Enzyme - types, properties, enzyme action. (Topics excluded: Nature of Bond

Linking Monomers in a Polymer, Dynamic State of Body Constituents Concept of Metabolism, Metabolic Basis of Living, The Living State)

Chapter-10: Cell Cycle and Cell Division
Cell cycle, mitosis, meiosis and their significance

UNIT-IV PLANT PHYSIOLOGY
Chapter-11: Photosynthesis in Higher Plants
Photosynthesis as a means of autotrophic nutrition; site of photosynthesis, pigments involved in photosynthesis (elementary idea); photochemical and biosynthetic phases of photosynthesis; cyclic and non-cyclic photophosphorylation; chemiosmotic hypothesis; photorespiration; C3 and C4 pathways; factors affecting photosynthesis.
Chapter-12: 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; amphibolic pathways; respiratory quotient.
Chapter-13: Plant - Growth and Development
Seed germination; phases of plant growth and plant growth rate; conditions of growth; differentiation, dedifferentiation and redifferentiation; sequence of developmental processesin a plant cell; plant growth regulators - auxin, gibberellin, cytokinin, ethylene, ABA.

UNIT-V HUMAN PHYSIOLOGY
Chapter-14: Breathing and Exchange of Gases
Respiratory organs in animals (recall only); Respiratory system in humans; 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.
Chapter-15: 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.

Chapter-16: Excretory Products and their Elimination

Modes of excretion - ammonotelism, ureotelism, uricotelism; human excretory system – structure and function; urine formation, osmoregulation; regulation of kidney function - renin - angiotensin, atrial natriuretic factor, ADH and diabetes insipidus; role of other organs in excretion; disorders - uremia, renal failure, renal calculi, nephritis; dialysis and artificial kidney, kidney transplant.
Chapter-17: 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 systems - myasthenia gravis, tetany, muscular dystrophy, arthritis, osteoporosis, gout.
Chapter-18: 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

Chapter- 19: 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 goitre, diabetes, Addison's disease.

INDEX

CHAPTER NO.	CONTENT	PAGE NO
	UNIT-I DIVERSITY OF LIVING WORLD	
1	The Living World	6
2	Biological Classification	9
3	Plant Kingdom	17
4	Animal Kingdom	24
	UNIT-II STRUCTURAL ORGANISATION IN PLANTS & ANIMALS	
5	Morphology of Flowering Plants	38
6	Anatomy of Flowering Plants	46
7	Structural Organisation in Animals	52
	UNIT-III CELL: STRUCTURE AND FUNCTION	
8	Cell-The Unit of Life	55
9	Biomolecules	60
10	Cell Cycle and Cell Division	65
	UNIT-IV PLANT PHYSIOLOGY	
11	Photosynthesis in Higher Plants	70
12	Respiration in Plants	78
13	Plant - Growth and Development	82
	UNIT-V HUMAN PHYSIOLOGY	
14	Breathing and Exchange of Gases	87
15	Body Fluids and Circulation	93
16	Excretory Products and their Elimination	97
17	Locomotion and Movement	100
18	Neural Control and Coordination	109
19	Chemical Coordination and Integration	116

CHAPTER 1: THE LIVING WORLD

Binomial nomenclature:-

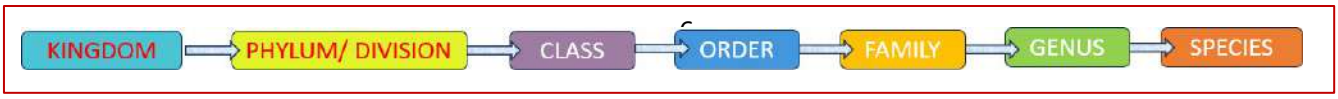
This naming system given by Carolus Linnaeus.The system of providing a name with two components, the generic and the species is called binomial nomenclature. Each name has two components – the **Generic name** and the **specific epithet**. Ex.

Scientific name	**Genus**	**Species Epithet**
Mangifera indica	Mangifera	indica

Some universal rules of nomenclature :-

- Biological names are generally in **Latin** and written in **italics.** They are Latinised or derived from Latin irrespective of their origin.
- The first word in a biological name represents the **genus** while the second component denotes the **specific epithet.**
- Both the words in a biological name, when handwritten, are separately underlined, or printed in italics to indicate their Latin origin.
- The first word denoting the genus starts with a capital letter while the specific epithet starts with a small letter. It can be illustrated with the example of *Mangifera indica*.

Hierarchy of Classification :(Taxonomic Categories):-



These are the level or rank based on the similarities and differences among the organisms in an established system of classification

Taxonomic Categories	Lion	Wheat	Man	Mango
Kingdom	Animalia	Plantae	Animalia	Plantae
Phylum/Division	Chordata	Angiospermae	Chordata	Angiospermae
Class	Mammalia	Monocotyledonae	Mammalia	Dicotyledonae
Order	Carnivora	Poales	Primata	Sapindales
Family	Felidae	Poaceae	Hominidae	Anacardiaceae
Genus	Panthera	Triticum	Homo	Mangifera
Species	*Panthera leo*	*Triticum aestivum*	*Homo sapiens*	*Mangifera indica*

QUESTION BANK

Multiple choice questions

1. Identify the botanical name of the potato-

a. *Solanum nigrum,* b-*Solanumtuberosum,* c-*Sonaumnigrum,*d-Noneof these

2. Amongst family, species and genera which will show the least similarity?

a. Species b-Family c- Genus d-Both b and c

3. A binomial nomenclature consists of _____ and_____. a) Generic name and Phyla b) Class and Phyla c) Generic name and specific epithet d) Phyla and Kingdom

4. Binomial nomenclature is given by _____ a) Carolus Linnaeus b) Charles Darwin c) Henry Cavendish d) James Chadwick

5. The process of grouping organisms based on similarities and evolutionary relationships is known as: a.Classification b) Nomenclature c) Identification d) Taxonomy

Assertion reason type question

6.

(a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.

(b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

(c) If Assertion is true but Reason is false.

(d) If both Assertion and Reason are false.

7. Assertion: Hierarchical system of classification is useful in that it reduces the volume of description in a catalogue of animals and plants.

Reason: Characters given for a larger category (say a phylum) need not be repeated for smaller categories (say classes, orders, etc.)

Answers

1	2	3	4	5	6	7
b	b	c	a	a	b	a

Very short answer questions

1. Expand ICZN?

Ans. International code of Zoological Nomenclature

2. Why is the binomial nomenclature system important for the scientific naming of organisms?

Ans. The binomial nomenclature system is important because it provides a **universal** and standardized way to name organisms. It eliminates confusion caused by local names that vary from place to place.

Short answer questions

1. Why do we need to classify the different organisms?

Ans: It helps in the identification of any species, helps in understanding biodiversity and evolutionary path, It helps in the systematic study of any organism

2. Write the correct sequence of the taxonomic hierarchy.

Ans: Kingdom---Phylum/ Division ---Order---Family ---Genus ---Species

3. Write A, B, C, D, E and F in the given table below.

Common Name	A	Wheat
Biological Name	*Homo sapiens*	*Triticum aestivum*
Species	*sapiens*	*aestivum*
Genus	*Homo*	*Triticum*
Family	B	Poaceae
Order	Primata	C
Class	D	Monocotyledonae
Phylum/Division	Chordata	E
Kingdom	F	Plantae

Ans. A-Man B-Hominidae C-Poales D-Mammalia E-Angiospermae F-Animalia

CASE BASED QUESTION

Read the following and answer the questions given below.

Classification is not a single-step process, but involves a hierarchy of steps, in which each step represents a rank or category. Each category, a unit of classification, represents a taxon. Taxonomical studies of all the known organisms have led to the development of certain common categories.

(a) Name and arrange the common categories in proper sequence in a hierarchy, from the lowest to the highest category v(b) Name the following

(i) The family that includes lion, tiger and leopard, all belonging to the genus Panthera.

(ii) The order that includes the plant families Convolvulaceae and Solanaceae.

Ans.Please refer text given above.

Long answer questions

a)Who proposed the concept of Binomial Nomenclature. Write the scientific name of housefly.

b) What are the rules of writing binomial nomenclature

a) Carolus Linnaeus proposed the binomial nomenclature. Musca domestica

Ans.Please refer text given above.

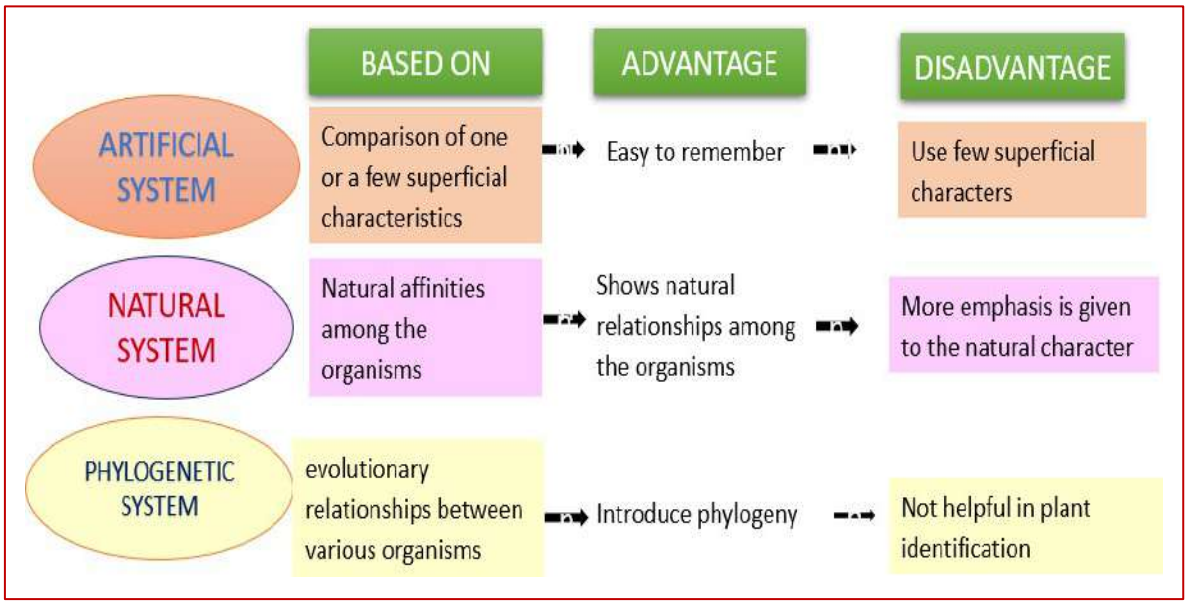
2. Explain in brief about the concept of species. Also, provide three examples of species.

CHAPTER 2
BIOLOGICAL CLASSIFICATION

TypesofTaxonomies

NumericalTaxonomy	Basedonquantity,Numbersandcodesareassignedtoallthecharacters and the data are then processed using a computer
Cytotaxonomy	Basedoncytologicalinformationlikechromosomenumber,structure , behaviour
Chemotaxonomy	Basedontheevidencefromchemicalconstituents

Type of classification system



Classification	**Proposed by**	**Kingdoms**
Two kingdom classification	Linnaeus	Plantae and Animalia
Five kingdom classification	R.H. Whittaker	Monera, Protista, Fungi, Plantae, Animalia.

Living World				
Monera	**Protista**	**Fungi**	**Plantae**	**Animalia**

R.H.Whittaker's 5 Kingdom classification of the living organism is based on the following 5 criterias:-

1	Structure of cells:-	Living organisms can be divided into two major categories on the basis of cell structure**:- i. Prokaryotic cells. ii. Eukaryotic cells**
2	Cellular Organization (thallus organisation):-	The principle of evolution has revealed that the earliest organisms were simple unicellular. But in due course of time they evolved into multicellular organisms, becoming finally complex
3	Modes of Nutrition:-	He classified organisms on the basis of autotrophic and heterotrophic modes of nutrition
4	Phylogenetic Relationship	Phylogeny is the evolutionary history of an organism. Therefore, Phylogenetic relationships of organisms are alone are the index of their true kinship
5	Reproduction:-	Reproduction is the basis of all living organisms. All organisms can multiply their numbers & ensures their survival

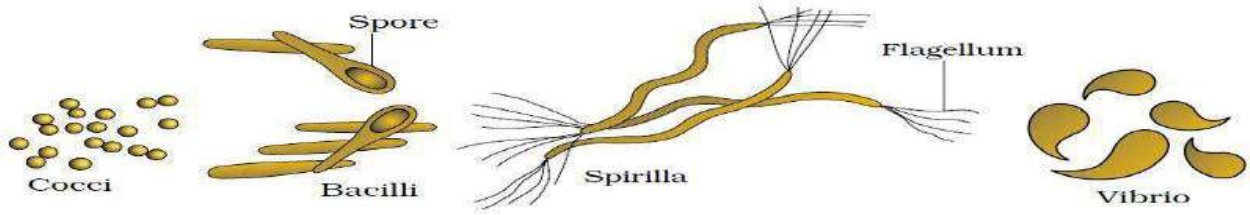
Characteristics of the Five Kindoms:-

SN	Characteristics	Monera	Protista	Fungi	Plantae	Animalia
1	**Cell Type**	Prokaryote	Eukaryote	Eukaryote	Eukaryote	Eukaryote
2	**Body Organisation**	Unicellular, cellular	Unicellular, Cellular	Multicellular, Tissue	Multicellular - cellular/ Tissue/ Organ	Multicellular- cellular/Tissue/ Organ/Organ system
3	**Nuclear Membrane**	Absent	Present	Present	Present	Present
4	**Mode of Nutrition**	Autotrophic (Photosynthetic/Chemosynthetic)Heterotrophic (Parasitic, Saprophytic)	Autotrophic (Photosynthetic) Heterotrophic (Parasitic, Saprophytic, Holozoic)	Heterotrophic (Saprophytic, Parasitic)	Photosynthetic	Heterotrophic (Holozoic Saprophytic, Parasitic)
5	**Cell Wall**	Present Non-cellulosic	Present in few, cellulose	Present, non-Cellulosic Polysaccharide (Chitin)	Present (Cellulose)	Absent

MONERA:-

- They Include Eubacteria, Cyanobacteria, Archaeobacteria, Mycoplasma, Actinomycetes etc.
- Cell is eukaryotic
- Mostly unicellular

Shape of bacteria



Categories of bacteria

Eubacteria	• Presence of a rigid cell wall, motile, a flagellum. • unicellular, colonial or filamentous, freshwater/marine or terrestrial. • Colonies are generally surrounded by gelatinous sheath. Some of these organisms can fix atmospheric nitrogen in their specialised cells called heterocyst e.g. Nostoc and Anabaena
Chemosynthetic bacteria	• Oxidize various inorganic substances such as nitrates, nitrites and ammonia • Play important role in recycling nutrients like nitrogen, phosphorous, iron and Sulphur
Heterotrophic bacteria	• Most abundant, decomposers/parasitic. • Beneficial as well as harmful. • Helps in production of antibiotics, nitrogen fixation in legumes. Some are pathogens and may cause diseases like Cholera, typhoid,

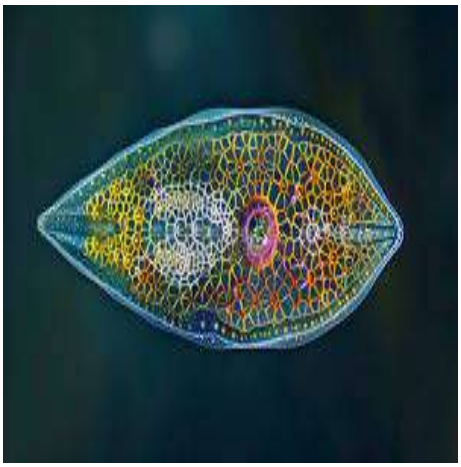
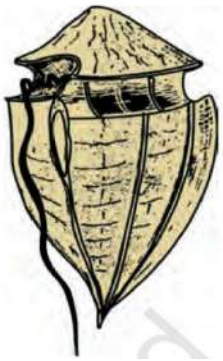
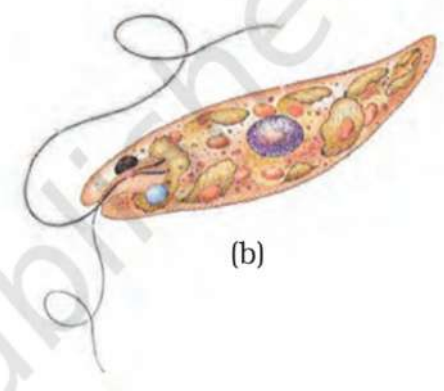
	Tuberculosis, tetanus and citrus canker.
CYANOBACTERIA (BLUE GREEN ALGAE)	• Habitat:- Aquatic, freshwater, marine,Moist soil and rocks, At the lower trunk of trees, Symbiotically with fungi (lichen), with coralloid root of cycas ,Hot water springs.Ex:- *Phormidium* In low temperature in polar region. Ex:-*Schizothrix.* • Body Organisation:-Unicellular Ex:- Dermocarpa. Multicellular, filamentous, unbranched without heterocyst. • Ex:-*Trichodesmium, Oscillatoria, Spirulina* etc. • Multicellular, filamentous, unbranched with heterocyst. • Ex:-*Nostoc, Anabaena, Aulosira, Cylindrospermum* etc. • Cell Structure:- • Mucilaginous sheath:- The cell wall is covered by a sticky mucilage sheath which is made up of mucopolysaccharide. • Cell Wall is made up of peptidoglycan. • Nutrition:- Photosynthetic. • Heterocyst:- These are the special type of cell present in the filament of some blue green algae. They consist of thick cell wall. without nucleoid and fix atmospheric nitrogen
ARCHAEOBACTERIA	• Habitat:- These are the most primitive bacteria originated on earth and can live in most extreme environment like Hydrothermal vents, salty (saline environment), hot sulphur springs, in the gut of ruminants. • The archaeobacteria can be divided into 3 groups:- a. Methanogens: - They can live symbolically in gut of ruminants. • They secretes enzymes for the digestion of cellulose in return they got food and shelter.Dung (contains methanogenic bacteria)produced by the cattles used for the production of biogas(main content is methane). • They are anaerobic. Ex: -*Methanobacterium, Methanococcus.etc* b. Halophiles: - They occur in extreme saline (salty) environment like salt lakes, salt marshes and salt solutions. • They are chemoautotrophs in nutrition. • Ex.*Halococcus, Halobacterium* etc. c. Thermoacidophiles: - They can live in hot and acidic environment like hot sulphur springs where temperature remain 80^0 C and PH 2 • They are chemoautotrophs in nutrition.Ex.*Thermoplasma,*
MYCOPLASMA	• They are the smallest living organisms., Size:- 0.1-0.2μm. • They are also known as **PPLO (pleura pneumonia like organisms)** • They are unicellular, non-motile and do not produce spore. • They are called “Jockers of plant kingdom” due to no definite shape.Cell wall is absent, and are anaerobic. • Nutrition:- Mostly parasitic and some saprophytic.Example:- Mycoplasma,
ACTINOMYCETES	• They are also called ray fungi. • They are unicellular,elongated,filamentous& occur in group. • They are anaerobic.,Nutrition:- Mostly saprophytic Reproduction:- They reproduce asexually by fragmentation, fission, and spores. Ex. Actinomyces, streptomyces etc.

PROTISTA

Protista are generally unicellular and eukaryotes.

These are broadly divided into three major groups:-

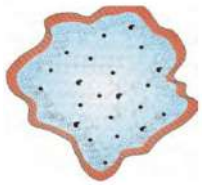
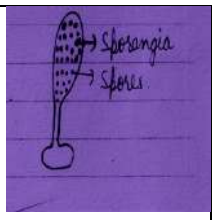
1.Protistan Algae	2.Protistan Fungi	3.Protozoan Protist
• Cryophytes (Golden algae and Diatoms) • Dino flagellates • Euglenoids	• Slime mould	• Amoeboid • Ciliates • Flagellates • Protozoan

1. CHRYSOPHYTES 	• They include diatoms and golden algae. • Habitat:- Aquatic-freshwater or Marine. • Nutrition:- It has photosynthetic nutrition. • Cell Wall:- The cell wall is composed of two thin overlapping halves which are overlapped with each other like soap in the soap box. It is embedded with silica. • Locomotion:-is of gliding type . When they locomote they secrete their cell wall deposits which accumulate over their habitat over billions of years which are known as diatomaceous earth. • This soil being gritty can be used in polishing and the filtration of oil and syrups. • Example:- *Pinnularia, Cyclotella* etc
2. **DINOFLAGELLATES** 	• Habitat: - Mostly marine. **Locomotion:-** locomotion by two flagella, one attachedlongitudinally and other transversally • Some species like red dinoflagellates like *Gonyaulax* undergoes such rapid multiplication that they make the entire sea surface red. This is called 'red tide'. Some dinoflagellates like *Gonyaulax* and *Noctiluca*shows the property of Bioluminescence (produce light) while some release toxins which can kill the aquatic organisms like fish. Cell Wall is present of cellulose. .Example:-*Gonyaulax, Noctiluca*.
3. **EUGLENOIDS**  	• Habitat:- Freshwater protist and live in stagnant water. • Locomotion:- Occurs by two flagella one long and one is short attached longitudinally. Nutrition:- Mixotrophic i.e. both photosynthetic and holozoic, In the presence of sunlight it forms food through photosynthesis. • In dark when there is no sunlight they ingest bacteria into its mouth (cytostome) and take them into the cytopharynx. • Cell wall is absent but covered by a protein layer called pellicle. • Cell contains all the phosynthetic pigment like that of higher plants. • Reproduction:- Binary fission. • Example:- Euglena.

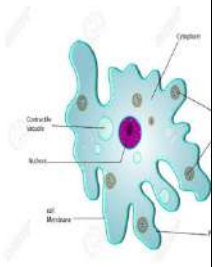
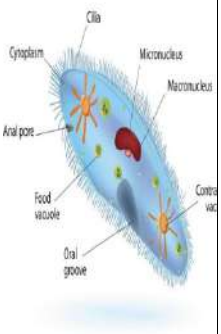
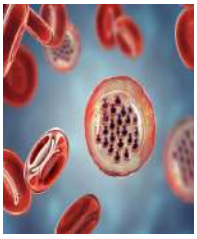
SLIME MOULD:-

- Habitat:- They lives as saprophytes i.e. swims freely along the decaying leaves, twigs etc.

- Cell Wall is absent in entire vegetative structure of plasmodium.Locomotion:- By PseudoplasmodiumExample:-*Physarum*

Under favorable conditions they grow and fuse to form a mass of aggregation of amoebae called Plasmodium.		**Under unfavorable conditions** the cells of plasmodium differentiate and divide to form spore producing body known as sporangia. In Sporangia, the various **thick walled** spores are formed which are dispersed by wind.	

PROTOZOAN PROTIST

1.AMOEBOID 	• Habitat: - Aquatic- Freshwater or marine. • Some species lives as parasites (ex. Entamoeba causes amoebic dysentery) • Locomotion:- It occurs by special cellular outgrowth present on its cell membrane, which are known pseudopodia. • Nutrition:- Mostly they are holozoic which ingest other microorganisms but some are parasitic. • Marine forms also contain silica shells on their surface. • Example:-*Amoeba, Entamoeba*
2.CILIATES 	• Habitat:- Aquatic and some are Parasitic (*Balantidium*) • Locomotion:- Occurs by hair – like projections present on their cells known as cilia. • Nutrition:- Holozoic. They ingest bacteria with the help of beating action of their cilia into their mouth, from where the food is transferred to cytopharynx. • Reproduction:- Binary fission. • They are mostly binucleated.and have Macronucleus:- Control all the vegetative activities of the cell. Micronucleus:- Help in reproduction as it contain genes for genetic exchange. • Osmoregulation is done by contractile vacuole. • Example*:- Paramecium, Balantidium, Vorticella, Opalina* etc.
3.FLAGELLATES	• Habitat:- Mostly parasitic, Some are free living, Some lives as symbionts. • Nutrition: - Holozoic, and parasitic. • Locomotion: - Occurs with the help of flagella. Examples: - *Trypanosoma gambience:-* Uniflagellated, Host:- Tse – Tse fly, Man, Disease:- Sleeping sickness *Leismania Donovani:-*Uniflagellated., Host- Sand fly, Man., Disease- Kala – azar or dum-dum fever. *Giardia intestinalis*:- Multiflagellated, Host- Man, Disease- Giardiasis (dysentery).It is regarded as the grand old man of the intestine.
4.SPOROZOAN 	Habitat:-Lives as endoparasite Locomotion:- It does not have cillia, flagella or pseudopodia for locomotion. They cause infection by a spore – like stage in its life cycle. Example:-*Plasmodium vivax*-Malarial Parasite. Host:- Female anopheles mosquito, man

KINGDOM FUNGI

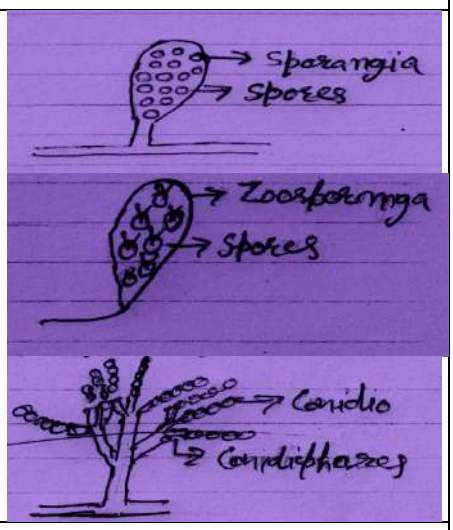
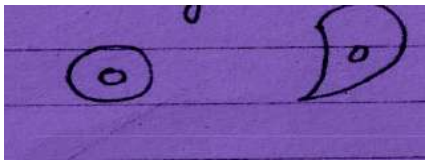
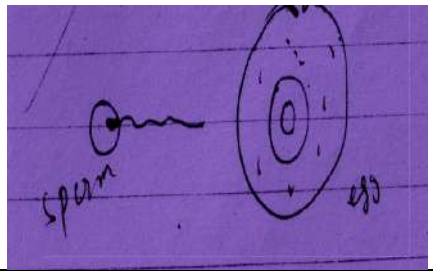
- Multicellular, eukaryotic and saprophytes

- Habitat: - air, water and soil, on decaying logs, on tree trunk, on few plants and animals,as parasites, Live symbiotically with algae (lichen) roots of higher plant-Mycorrihiza.
- They mostly grow in warm and humid places.

Body Organisation: - Cell:- Eukaryotic, filamentous body called mycelium

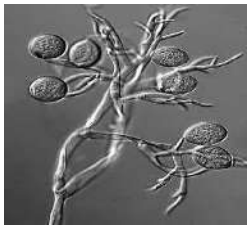
- Cell wall is made up of Chitin.

Reproduction:-

Vegetative Reproduction	by fragmentation, budding and fission	
Asexual Reproduction	by formation of spores which are of following types a. Sporangiospores • Thick walled, Very light • Non- motile, endogenous • Formed inside sporangia b. Zoospores-Thin walled, Motile and flagellated.Endogenous, Formed inside zoosporangia c. Conidia-Non-motile,Arise mostly in chain and from exogenously on the special hyphal branches called conidiophores.Dispersed in the air	
Sexual reproduction	Types of sexual fusion: a. Isogamy:- The fusion between two morphologically similar gametes b. Anisgamy:- The fusion between two morphologically dissimilar gametes c. Oogamy:- It is the fusion between small and motile male gametes with the large and non-motile female gamete **Stages of sexual reproduction** • Plamogamy:- Fusion of cytoplasm of the two cells • Karyogamy:- The fusion of the nucleus of two cells • Meiosis:- It occurs in the zygote and result in the formation of four haploid spores, which are called meiospores. These spores germinate and forms new fungi	 

❖ In some fungi like ascomycetes and basidiomycetes, the plasmogamy is delayed by karyogamy and results in the formation of a binucleated cell which is known as dikaryon cell and the phase is known as dikaryophase.

CLASSIFICATION OF FUNGI:-

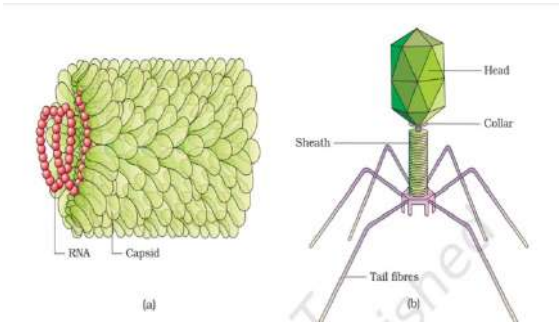
DIVISION	CHARACTERISTCS	EXAMPLES
OOMYCETES 	• Mycelium is aseptate i.e. septum absent multinucleated /coenocytic condition. • Asexual reproduction occurs by the formation of spores Terrestrial form **(sporangiospores)** Aquatic form **(Zoospores)** • Vegetative propagation occurs by fragmentation • Sexual Reproduction:- The sexual reproduction is **isogamous** or	

	oogamous. • Plasmogamy is immediately followed by Karyongamy and result in the formation of zygote **(oospores)** • The meiosis occurs in the oospores and result in the formation of haploid meiospores which germinate to form new fungi. • ***Phytophthora*** **(*Cause late blight of potato*),*Albugo*** **(*White rust of crucifer (mustard*)),*Pythium*** **(*cause damping off disease)***
ZYGOMYCETES (Oomycetes and zygomycetes are together known as **phycomycetes)**	• Mycelium is aseptate i.e. septa absent, Coenocytes condition. • Asexual reproduction occurs by **sporangiospore.** • Plasmogamy is immediately followed by karyogamy and result in the formation of **zygote (Zygospore).** The meioses occur in the zygospore and result in the formation of haploid meiospore which germinate to form new fungiEx.Rhizopus, Mucor,
ASCOMYCETES 	• It includes **unicellular** /**multicellular** forms.Mycelium is septate, • **Asexual Reproduction:-** 1. Yeast, reproduction occurs by binary fission and budding. • In others, it occur by **conidia** • Plasmogamy is delayed by karyogamy and result in the formation of a **ascus mother cell**, which undergoes karyogamy and forms a diploid zygote or **ascus**. The ascus divide first by meiosis and then by mitosis and results in the formation of 8 haploid **ascospore**, which germinate to form new fungiUnicellular – Yeast, Multicellular-*Aspergillus , Penicillium* • *Sacchomyces cerevicae* (Yeast),*Neurospora* used as study in experimental genetics, *Aspergillus (smoky mould)* *Penicillium (produce antibiotic penicillin), Claviceps(cause ergot of Rye)*
BASIDIOMYCETES 	• They are **multicellular**. • Mycelium is septate, uninucleated condition • Asexual reproduction occurs by the formation of **Chlamydia or oldia.** • Plasmogamy is delayed by karyogamy, which results in the formation of • **basidium mother cell**which undergoes meiosis and forms 4 haploid meiospore known as **Basidiospores**, which germinates and forms primary mycelium. • **Basidium**:- In some higher fungi the aggregation of basidia is present, they are known as basidiocarp. Ex:- Mushroom, Bracket fungi. ***Agaricus compestris*** (Mushroom)edible ***Puccinia*** (*It is parasitic and cause black, yellow and brown rust of wheat*), ***Ustilago*** (*smut disease of wheat*),***Amanita Muscaria*** (poisonous mushroom),***Lycoperdum***(Puff Balls)edible***Armillaria*** *(honey mushroom).*
DEUTEROMYCETES	• Asexual reproduction occurs by the formation of conidia, oidia and chlamydospores. • Sexual reproduction is either absent or not reported. • Consists of well-developed septate mycelium, uninucleate condition ***Alternaria****(cause early blight of potato)*,***Trichoderma*** (produces drug Cyclosporin–A, which act as immunosuppressive agent ***Colletotrichum falcatum*** (*cause red rot of sugarcane*)***Cercospora*** (*cause tikka disease*),***Giberrela fujikuroi*** (produce gibberellins)

Viruses

- Non- Living when outside their specific host cell. Viruses are obligate parasites
- Composition:-It is made of an outer protein coat and inner genetic material (RNA / DNA).

- Virus that infects plants have single stand RNA and those infect animals have either single or double RNA or double stranded DNA.
- Bacteriophages are viruses that infect the bacteria.
- Viruses cause disease like mumps, small pox, herpes, influenza and AIDS.



Viroids

- Infectious agent smaller than viruses cause potato spindle tuber disease.
- It was found to be a free RNA; it lacked the protein coat that is found in viruses, hence the name viroid.
- The RNA of the viroid was of low molecular weight.

Lichens

- Lichen is the symbiotic association between algae and fungi.
- Phycobiont is algal component of lichen, which prepare food for fungi and Mycobiont is a fungal component of lichen, which provide shelter and absorb mineral nutrients and water for its partner.

  Algae prepare food for fungi and fungi provide shelter and absorb mineral nutrients and water for its partner.
- Lichens are very good pollution indicators and do not grow in polluted areas.

QUESTION BANK

Multiple choice questions

1. Which of the following is correctly matched?

Member	Stored food
A. Chrysophytes	i) fat
B. Dinoflagellates	ii) starch
C. Protozoa	iii) Fucoxanthin
D. Euglenoids	iv) Chrysolaminarin

2. Which among the following is not a eukaryote?
   A. Nostoc B. Mycobacterium C.A and B both D.none of the above
3. The infection in Viroids is caused by
   A. protein B. RNA C. DNA D. Glycophosphate
4. Which among the following is not a viral disease
   A. AIDS B. COVID-19 C. Spindle tuber disease D. None of the above

Answers: 1c, 2c, 3b, 4c

Very short answer questions

1. In which of the following kingdom are Archaeobcreria and Nitrogen-fixing organisms classified?
   Ans. Monera
2. African Sleeping Sickness is caused by _____.
   Ans. Trypanosoma gambiense
3. Blue-green algae belong to which group?
   Ans. Prokaryotes
4. What do we call the symbiotic association of algae and fungi.
   Ans. Lichen

Short answer questions

1. Explain the dikaryon stage in fungi. Also, give two examples that show such assemblage.
2. Who discovers Viroids? Name one plant disease caused by Viroids.
3. Give an example of one organism which behaves as both a phototrophic and heterotrophic mode of nutrition based on the availability of sunlight. Also, mention the group to which it belongs.

Long Answer Type Questions

1. a)What is peculiar in the cell wall of diatoms?

b)What is diatomaceous earth? How it is formed?

2- Protozoans are a very important kingdom. Give a detailed account of the classification of protozoans and list their examples.

Ans: please refer to the text given above.

CASE BASED QUESTION

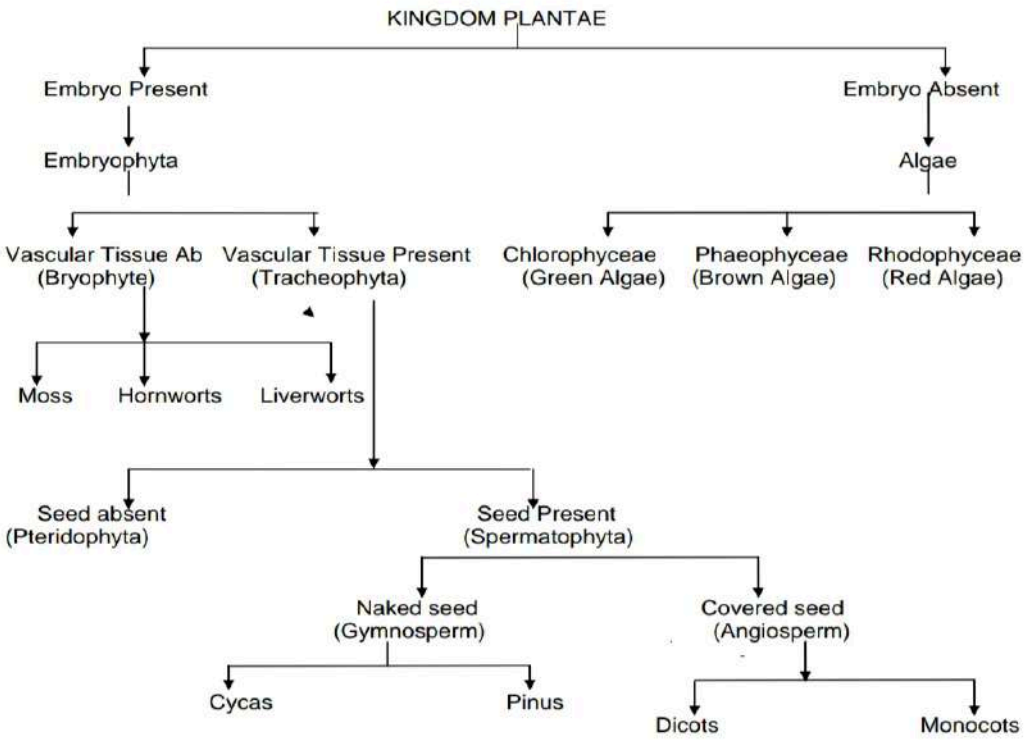
Read the following and answer the questions given below

Q.1 A scientist discovers a single-celled organism in a hot spring. The organism has a nucleus and other membrane-bound organelles, but it also has a cell wall made of cellulose. It can obtain food by absorbing nutrients from the environment, but it can also capture sunlight for energy production.

a) Based on the characteristics described, to which kingdom would this organism most likely belong according to the five-kingdom classification? Briefly explain your answer. (2marks)

b) Name an organism which shows mixotrophic mode of nutrition and how it is significant?

CHAPTER- 3 PLANT KINGDOM



ALGAE

- Habitat:- Freshwater or marine,Moist soil, rocks and tree trunksBody Organization:- Unicellular, Colonial, Filamentous unbranched, Filamentous branched ,Some higher algae are divided into root like holdfast, stem like stripe and frond (lamina).
- Nutrition:- Photosynthetic and contain photosynthetic pigments.
- Cell- Wall is made up of cellulose.

- Vascular tissue like xylem and phloem are absent.
- Reproduction:-

Vegetative:- By fragmentation.
Asexual:-By spore formation. Zoospores (Motile spore)/ Sporangiospores (non-motile spores)

- Sexual Fusion:- Isogamies/Anisogamous/Oogamous
- Alternation of generation:-

TYPE OF ALGAE:-

1 CHLOROPHYCEAE (Green algae)	• Habitat:- mostly freshwater few marine, Moist soil and tree trunk. • *BodyOrgenisation:- unicellular Ex-Chlamydomonas, Chlorella, Acetabularia*. Colonial-Ex-*Volvox*.,Filamentous unbranched Ex-*Spirogyra, Ulothrix, Oedogonium,* Filamentous branched Ex-*Ulva, Chara*. • Nutrition:-Photosynthetic, Photosynthetic Pigment:- Chlorophyll a, b. Cell consists of one or more chloroplast which may be discoid, plate like, reticulate, spiral, cup shape etc. Each chloroplast is associated with a starch storing body made up of protein called as paranoids, Reserve food material:- Starch but some algae may store oil droplets also. • Reproduction:- Vegetative reproduction:-By fragmentation. Asexual reproduction:-By Zoospores. Ex:- *Chlamydomonas, Volvox*, Sexual fusion:- Isogamous Two flagellated gametes Ex:- *Chlamydomonas, Ulothrix.* Both non-flagellated gametes Ex:- Spirogyra, cladophora. Anisogamous Ex:- *Chlamydomonas* Oogamous Ex- *Volvox*, *Oedogonium.* • Alternation of generation:- Most green algae undergoes haplontic life cycle. Ex: - *Ulothrix, Spirogyra, Chlamydomonas, Qedogonium*. Diplomatic life cycle Ex:- *Caulerpa*. Haplo-diplontic life cycle Ex: - *Ulva, Cladophora*. • Economic importance:–Photosynthetic, help in cleaning the environment. Used as food Ex:- *Chlorella, Ulva*. Used as food for space travelers. Ex:- *Spirulina.* The *Chlorella* produces an antibiotic chlorallin.
2 PHAEOPHYCEAE (Brown algae)	• Habitat – Mostly marine, Very few are freshwater. • Body Organisation:- Unicellular and filamentous unbranched forms are absent, Filamentous simple branched.Ex:- *Ectocarpus*. Filamentous profusely branched Ex:- kelps (Which may attain a height of 100 m) Nutrition:- Photosynthetic, Photosynthetic Pigment:- Chlorophyll a, c and a large amount of Fucoxanthin. • Cell Wall is made up of cellulose and it is covered by a spherical water holding substance i.e. hydrocolloid made up of align. • The higher brown algae can be differentiated into the stalk, holdfast attached to the substratum, stem like stalk and leaf like frond/ lamina. • Reserved food material:- Manitol and laminarian starch. • Reproduction:- Vegetativereproduction:- By fragmentation. Asexual reproduction:- By biflagellate zoospores, where are pear shaped and has two unequal flagella attached laterally. • Sexual Fusion:- Isogamous-Ex:- *Ectocarpus*, Anisogamous-Ex:- *Cutleria*,

	Zoogamous-Ex. *Fucus, Laminaria, Dictyota* Fertilization takes place in water and the sex organs like antheridia and ooagonia are formed. • Alternation of generation:- Mostly Haplo-diplontic. Ex:- *Ectocarpus, Dictyota*, Kelps. • Diplomatic Ex:- *Fucus, Sargassam* • Economic importance: - Used as food.Ex: - *Laminaria, Sargassam* Laminaria Saccharine is also known as kombi, which is rich in carbohydrates. The hydrocolloids i.e. alginic acid is used as thicker in the preparation of soap, cream, ice-cream, polish and gels. The laminaria provide on effective blood anti-coagulant. i.e. Sodium Laminarian sulphate
3 RHODOPHYCEAE (Red Algae)	• Habitat:- Mostly marine and few are freshwater, Generally attached to rock surface (Lithophytes'),. • Body Organisation:- Unicellular Ex:- Porphyridium. Filamentous branched Ex:- Polysiphonia, gelidium • Nutrition:- Photosynthetic ,Photosynthetic pigment:- Chlorophyll a, d and phycoerythrin (Red),Reserve food material: Floridian starch. • Cell wall is made up of cellulose and it is covered by a water holding substance i.e. hydrocolloid made up of carrageen. • Reproduction. Vegetative reproduction:- by fragmentation. Asexual reproduction:- by formation of non-motile spores. **Sexual fusion**:- Oogamous. Sex organs antheridia and oogonia are formed. Ex:- *Polysiphonia, gelidium, gracilaria* and *porphyridium.* • Alternation of generation:- Haplo- diplomatic Ex:- *Polysiphonia.* • Economic importance:-Used as food. Ex:- *Porphyridium*. Delirium and gracilaria produce agar which is used in culture medium and in the preparation of Ice- cream and jellies. Carrageen is used as an emulsifier in chocolates, ice-cream and jellies, • It is used to obtain bromine. Ex:- *Polysiphonia*.

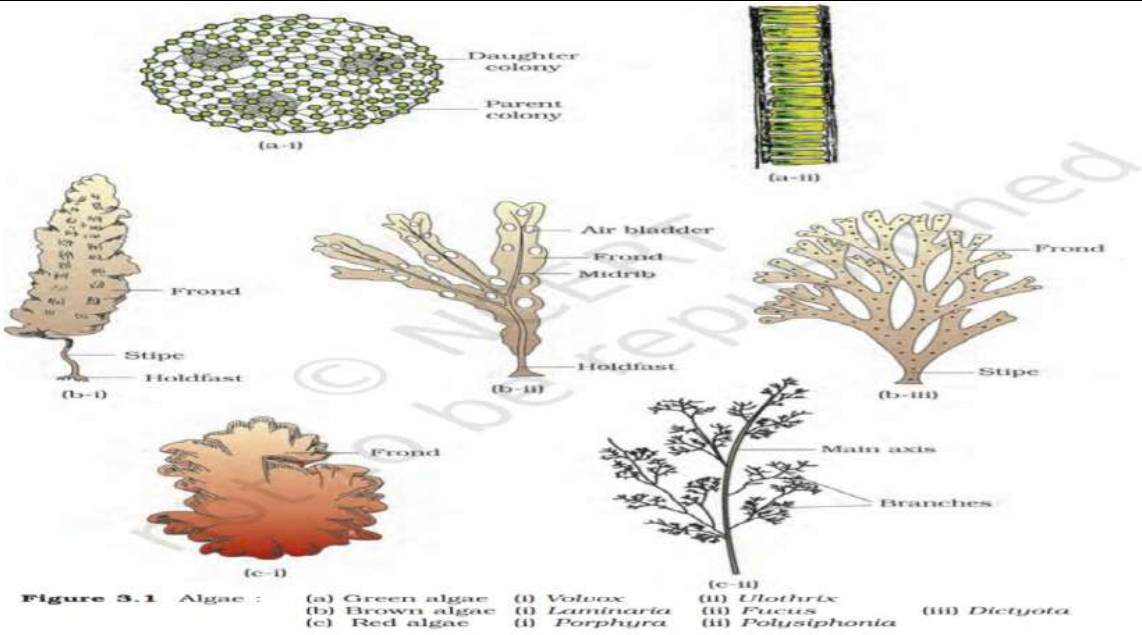


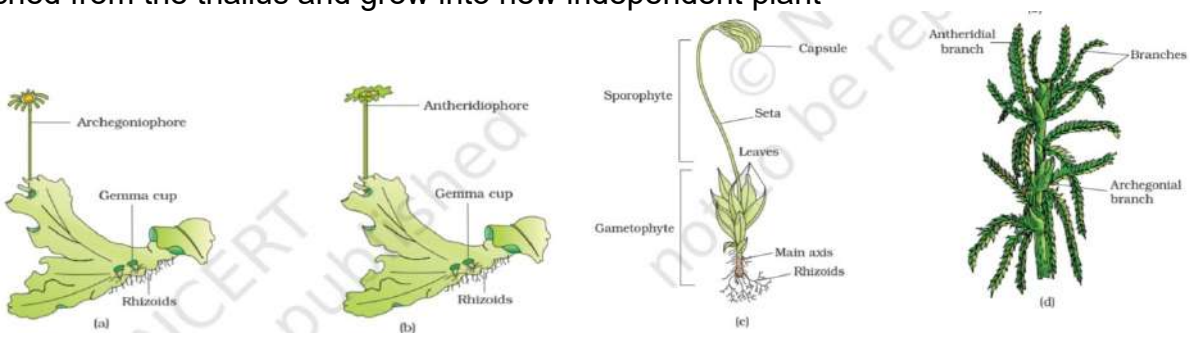
Figure 3.1 Algae : (a) Green algae (i) *Volvox* (ii) *Ulothrix* (iii) *Dictyota*
(b) Brown algae (i) *Laminaria* (ii) *Fucus*
(c) Red algae (i) *Porphyra* (ii) *Polysiphonia*

BRYOPHYTA

- Commonly called **amphibians of plant kingdom** because they live in soil but require water to complete their life cycle.
- Habitat:- They are found in damp, humid and shady place.
- Requirement of water:- for dehiscence of antheridia, liberation of antheroizoids (sperm)and transfer of antheroizoids from antheridia to archegonia , Opening the neck of archegonia
- Vascular tissues i.e. xylem and phloem are absent
- Body Organization:- Body is mostly thalloid that is not differentiated into root, stem and leaf (liverworts) or can be divided into leafy shoot having stem like or root like organs (mass).
- **Reproduction:-**

Vegetative (asexual):- Occurs by two methods:-

1. **By fragmentation**. Similar to algae.
2. **Gemmae:-** They are the special reproductive asexual buds that are enclosed in a cup like structure on the dorsal surface known as **gemma cup**. In adaptable conditions these buds detached from the thallus and grow into new independent plant

3. 

Sexual Fusion:- Oogamous.

Male sex organ:-**Antheridia**, Female sex organ:-**Archegonia(oogonia).**

- Alternation of generation:- They involve haplo-diplontic life cycle in which a dominant green multicellular haploid gametophyte phase is following by comparatively short lived non-green diploid saprophytic phase.

1. Liver worts:-

- Habitat:- On bank of stream, Marshy ground, damp soil, Bark of trees, Deep in the woods, Plant body is gametophyte. It is green and thalloid i.e.- dorsiventral
- Reproduction:-
  Asexual:- By fragmentation of thallus and by gamma.
  Sexual: - It occurs by the formation of antheridia on the special reproductive braches called antheridiophore and by archegonia which is born on the special reproductive branches called archeogoniophores.
- Ex:-***Marchantia, Riccia. Anthoceros*** etc
- The fertilisation occurs with the help of water to form zygote which divided by mitosis and forms saprophyte.
- Saprophyte consists of three parts:-1.Foot, 2. Setae, 3. Capsule
- Rhizoids are unicellular and unbranched, Saprophyte is less elaborated.
- In liverworts, the gametophyte is completely independent but sporophyte is partially or wholly dependent over gametophyte.

2.Mosses:-

- Habitat:- Same as bryophytes.
- Body Organisation:- Plant body is **gametophyte** a leafy shoot which is differentiated into root – like, stem-like and leaf like organs.
- Reproduction:-
  Vegetative:- by fragmentation and by budding in secondary peritonea.

Sexual:- The sex organs antheridia and archegonia are mostly formed on the same plant.
Example:- Funaria, Polytrichum. Water is needed for fertilization.

- Zygote is formed after fertilization which divided to form a well -developed diploid saprophyte which is dependent on gametophyte. The meiosis occur in the cells of saprophyte which result in the formation of haploid spores.
- Spores germinate to form an initial filamentous branched stage known as peritonea, which became highly branched structure called secondary peritonea and finally forms leafy stage.
- Rhizoids are multicellular and branched, Saprophyte is more elaborated.
  Ex:- Funaria, Polytrichum, Sphagnum.
- Economic Importance:- Provide food for herbaceous mammals, birds and other animals.
- Some species like sphagnum provide peat (like a coal) which is used as fuel.
- They contain good amount of water so that they can be used packaging material for the transport of living material.

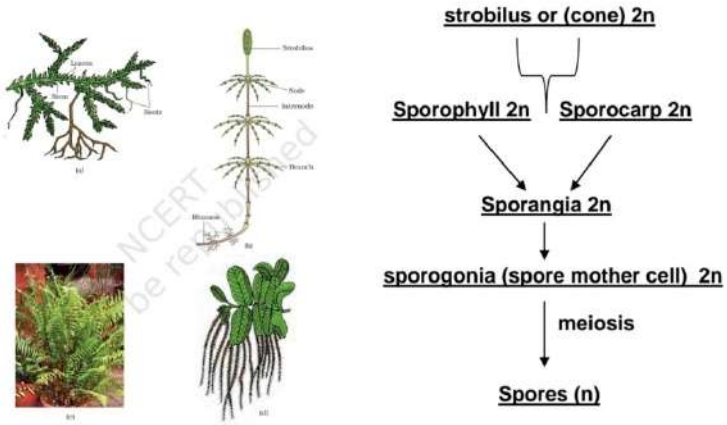
PTERIDOPHYTA

- Commonly includes ferns and horse-tails.
- Habitat:- In cool, shady and damp places, Some can live in sandy places.
- Body Organisation:- Plant body is **sporophyte** which is highly dominant, green, diploid and photosynthetic. The plant body is differentiated into true stem, root and leaf.
- Vascular tissue i.e. xylem and phloem are present.
- There are two types of leaves:-

Microphyllus Ex:- *Selaginella, Equisetum, Macrophyllus* Ex: - Ferns.

- Reproduction:-Sexual fusion:- Oogamous, Water is needed for fertilization similar to brypphytes.
- Sporophyte forms spore producing body called sporangia which is present in the

•Sporocarp Ex:- *Marsilea*, Sprophyll Ex:- *Selaginella*,ferns, Strobilus or (cone) Ex:- *Equisetum*.
•The meiosis occur in the **spore mother cell** of spore producing body to form haploid spores



- Spores can be homosporous Ex:- *Lycopodium, Pteridium*, all ferns etc,or heterosporus
  Ex:- *Selaginella, Salvinia, Marsilea*.
- Spore is the first cell of gametophyte generation and it germinate to form gametophyte, which is a comparatively short lived, multicellular photosynthetic or saprophytic and free-living.
- Water is needed for the fertilization and after fertilization diploid zygote is formed, which germinate to form main saprophyte plant body.
- The zygotes temporarily stay in the archegonia and forms embryo. (This is the evolution of seed habit). Ex:- Horsetail:- *Lycopodium, Equisetum*.
  Fern:- *Pteridium, Petris, Azolla*, Others:- *Salvinia, Marsilea* etc.
- Economic Importance:- Provide food for animals. Ex:- Sporocarp of mars ilea is edible.

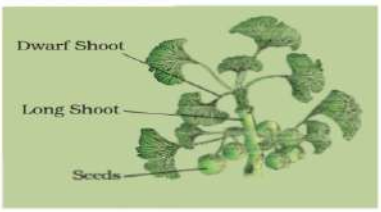
Ornamental Value.Ex:- *Adiantum*. Also called as walking fern because it propagates vegetative by its leaf tip ,Medicines:- Ex:- *Dryopteris* used as antihelimintic.
Lycopodium:- Arthritis, Lungs and Kidney diseases.*Adiantum:-* used to cure throat infections.

GYMNOSPERM

- Habitat – Grow mostly in hilly regions where the climate remains cold and the source of water is snow rather than rain. ex pinus
- Body organization:– Plant body is sporophytic which is main, green, photosynthetic, diploid and independent. It is differentiated into true root, strem and leaf.
- The leaves may be simple or compound Vascular tissue like xylem, phloem are well developed.
- Stem is non-porous (vessels are absent), The plant body may be branched (Pinus) or unbranched (Cycads, cycas).
- Reproduction:- Spores are formed on special spore forming body called sporangia which are born on sporophyll**.**
- An aggregation of sporophyll is strobilus or cone. The male and female cones are produced either on same plant (ex. *Pinus*) or on different plant.(ex. *Cycas*). The female cone forms mega sporophyll and mall cone forms microsporophyll.
- The spores are formed on the spore forming body (sporangia) and the spore mother cell (sporangia) undergoes meiosis and from haploid spores.
- The spores of gymnosperm are always heterosporous i.e. microspore and megaspore.
- The microspores germinate to from male gametophyte which consists of only limited number of cells while the megaspores germinate to form female gametophyte which consists of few cells.
- Unlike bryophyte and Pteridophyte, gametophytes of gymnosperm are always dependent on sporophyte. Female gametophyte is protected by saprophytic tissue i.e. nucleus and integument and forms ovule. During fertilization, the microspore (pollen grains) is carried to ovule through wind. This process is known as pollination. Here the pollen grains germinate and form pollen tube. Then it releases its male gamete into the archegonia. Fertilization occurs and zygote is formed and it will change into embryo. Ovule develop into seed ,which dehisce and fall down on the earth and germinate.
- Alternation of generation:-Diplontic. Example :– *Cycas, Pinus, Ephedra, Ginkgo* etc
- Economic importance:- Cultivated in gardens as ornamentals. They are used as source of wood.

(a)

(b)



(c)

ANGIOSPERMS

- Habitat:- Highly evolved plants group and have varied habitat found in land, water, on as epiphytes,
- Body organization:– Plant body is **sporophytic** which is main, green, photosynthetic, diploid and independent. **Gametophyte** is very short consist of only few cells and are always dependent on sporophyte.
- Plant are categorized into herbs, shrubs and tree.
- The spores of gymnosperm are always heterosporous Sporophylls are aggregated to form sexual organs called flowersThe pollen grains and ovules are developed in specialized structures called stamens (microsporophylls) and carpels (megasporophylls) respectively in flower
- Stamen consists of a filament and an anther. Carpel consists of a stigma, style and ovary.
- Pollination involve the transfer of pollens from anther to sigma with the help of pollinating agents like water, wind, insects, or birds etc.
- Pollen carry the male gamete from stigma to the ovule where fertilization occurs to form zygote. Zygote develops into embryo inside the ovule and grow to form new plant.
- The ovule develop into seeds and ovary develop into fruit.

Examples:- mango. sheesham, rose, apple, bamboo. castoe, neem, wheat, rice, maize, tomato,etc

QUESTION BANK

Multiple choice questions

1.)Rhodophyceae is called red algae because of the pigment
(a) Fucoxanthin (b) Phycoerythrin (c) Carotenoids (d) Chlorophyll c
2.)In a monoecious plant
(a) Male and female sex organs are on the same individual
(b) Male and female gametes are of two morphologically distinct types
(c) Male and female sex organs are on different individuals
(d) All the stamens are fused to form one unit
3)The seedless vascular plants whose sporophytes are larger than their small and independent gametophytes are
(a) Pteridophytes (b) Angiosperms (c) Gymnosperms (d) None of these
4. A plant that has seeds but no flowers and fruits?
a)) Bryophytes b) Gymnosperms c) Mosses d) Pteridophytes
5. Plants that possess spores and embryo but lack vascular tissues and seeds?
a) Rhodophyta b) Bryophyta c) Pteridophyta d) Phaeophyta
6. Pick the mismatched pair
a) *Cycas* –Dioecious b) *Equisetum* –Homosporous c) *Salvinia* –Heterosporous d)*Pinus* –Dioecious
7. Double fertilization is the characteristic of ----------.
a) Algae b) Gymnosperms c) Fung d) Angiosperms

ASSERTION AND REASON QUESTIONS

A. If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.
B. If both Assertion and Reason are true but the Reason is not a correct explanation of the Assertion.
C. If Assertion is true but the Reason is false.
D. If both Assertion and Reason are false
8. **Assertion:** Chlorella could be utilized to keep the air pure in space vehicles.
Reason: The space travellers feed on Chlorella soup.
9. **Assertion:** Red algae contribute in producing coral reef.
Reason: Some red algae secrete and deposit calcium carbonate on their walls.
10. **Assertion:** Gymnosperms do not produce fruit.
Reason: Ovules of gymnosperms are enclosed within the ovaries.

1	2	3	4	5	6	7	8	9	10
b	A	a	d	b	b	d	b	a	c

Very short answer questions

1. List the name of stored foods in any two algal groups.
Ans: Floridian starch in Rhodophyceae. Mannitol in Phaeophyceae.
2. Mention any two adaptive features of leaves of gymnosperms.

Ans: In conifers, the needle-like leaves reduce the surface area. Their thick cuticle and sunken stomata also help to reduce water loss

Short answer type questions

1. What is the basis of classification of algae?

2. What is heterospory? Briefly comment on its significance. Give an example:

Competency based questions

1..Does heterospory have some evolutionary significance in the plant kingdom?

2..Mention the ploidy of the following: Protonemal cell of a moss; primary endosperm nucleus in dicot, leaf cell of a moss; prothallus cell of a fern; gemma cell in Marchantia; meristem cell of monocot, ovum of a liverwort, and zygote of a fern.

3.What do you mean by seed habit in pteridophytes?

4. What features led to the dominance of vascular plants?

Ans. The features which led to the dominance of vascular plants are:

(i) Development of deep roots with the ability to penetrate the soil.

(ii) Development of water-proofing material eg. cutin on aerial surfaces, to reduce water loss through evaporation.

(iii) Development of strong woody material anchor and support above-ground structures

Long answer questions

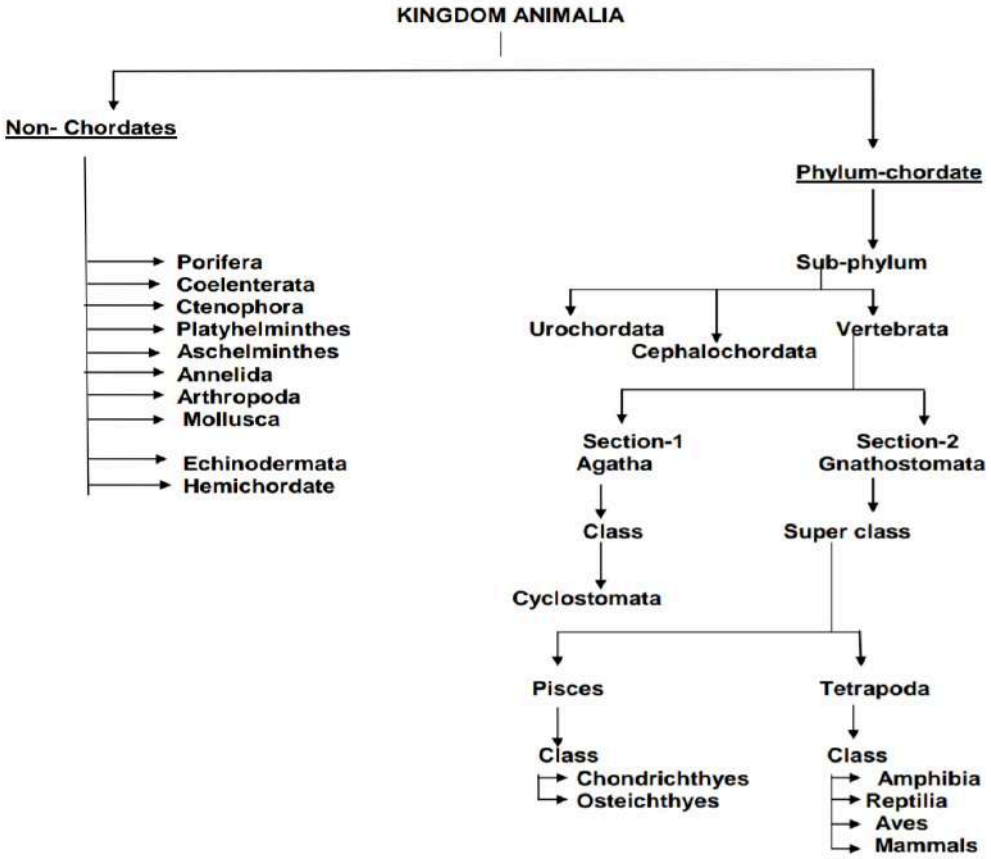
1. Write the economic Importance of Gymnosperms and Algae.

2. Explain briefly the following terms with suitable examples:-

(i) Protonema (ii) antheridium (iii) archegonium (iv) sporophyll (v) isogamy

3. List properties of brown algae based on the following features- a. Habitat, shape, pigment, reserve food, cell wall, leaf, and reproduction.

CHAPTER- 4 Animal Kingdom



BASIS OF CLASSIFICATION:-

• **Level of organization**
• Cellular level oforganisation:-The cells are loosely arranged and don't from tissues. Ex: -

Porifera (SPONGES).

- Tissue level of organisation: - The cells combine to form tissue and have similar structure & function .Ex:- Coelenterates, Ctenophore.
- Organ level of organisation: - The two or more tissues combine to form organs.Ex:- Platyhelminthes.
- Organ-system level of organisation:-The two or more different organs combine to form organ system.Ex:- Aschelminthes to all chordates

- **Digestive tract**

- **Incomplete:-**There is a mouth but no anus.
  Ex:- Coelenterates, Platyhelminthes.
- **Complete:-** They contain both mouth as well as anus.
  Ex:- Ctenophore , As helminthes to all chordates

- **Circulatory system**

- **Open circulatory system:-**In this the blood after flowing from heart remains in direct contact with the body cells. Here, sinuses are formed.
  Ex:- Arthropoda, mollusks, hemichordate
- **Closed circulatory system:-** In this the blood after flowing from heart does not make direct contact with the body cells .
  Ex:-Annelids, Echinodermata and all chordates.

Symmetry

- **Bilateral symmetry**:-When a plane is drawn at only one axis of the body and the body shows two identical parts. Ex:-All chordates.
- **Radial symmetry**:- When a plane drawn at more than one axis of the body and the body two identical parts. Ex:-Coelentrates (hydra, sea anemone), ctenophores, adult echinoderms(star fish), etc.

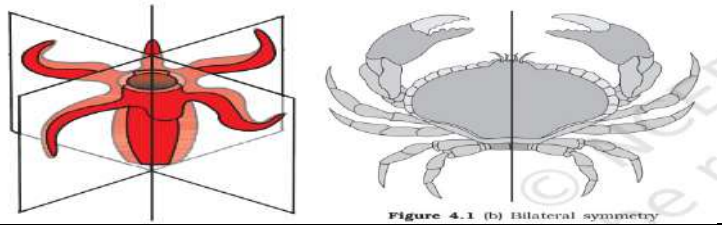
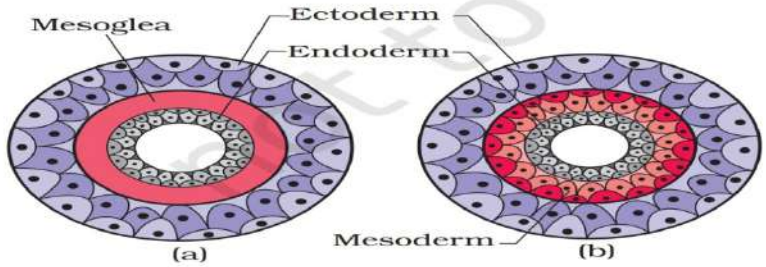


Figure 4.1 (b) Bilateral symmetry

Germ layer

There are three germ layers celled ectoderm, mesoderm and endoderm.

- Diploblastic:- Outer ectoderm and inner endoderm .
  Ex: - Porifera, coelenterate and ctenophore.
- Triploblastic:- All the three layers are present .
  Ex:- Platyhelminthes to all chordates



Coelom It is the body cavity which provides space to the visceral organs.

1. Acoelomate: - The animals in which the body cavity is absent.
Ex:- Porifera, coelenterate, ctenophore.
2. Coelomate:-The coelom is formed in the mesoderm and is completely lined by it. Ex: - Annelids to all chordates.
3. Pseudocoelomates:- In some animals the mesoderm is present as scattered pouches between the ectoderm and endoderm. So that the coelom is not completely lined by mesoderm.Ex:- Aschelminthes (roundworm).

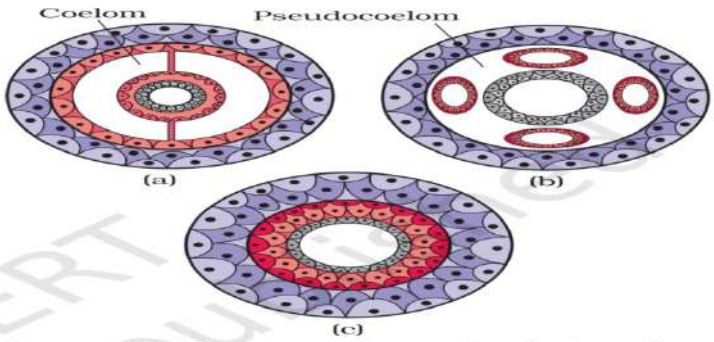


Figure 4.3 Diagrammatic sectional view of : (a) Coelomate (b) Pseudocoelomate (c) Acoelomate

Segmentation(metamerisation)

In some organism the body is externally and internally divided into various segments called metamers with serial repetitions of at least some organs.
Ex: - Annelids, Arthropods.

Notochord

It is a mid-dorsal, solid, unjointed, rod –like structure present on the dorsal side of body.
- In vertebrate notochord is replaced by hollow and jointed str. Called vertebral column.
- The animal with notochord is known as chordate.
  Ex:- Hemichordates to all vertebrates.
- The animal without notochord is known as non-chordates.
  Ex:- Porifera to echinodermata.

ALL VERTEBRATES ARE CHORDATES, BUT ALL CHORDATES ARE NOT VERTEBRATES

NON CHORDATES PHYLUMS

Porifera-

- Commonly known as sponges.
- Habitat:- Mostly marine,While very few are freshwater.Ex: - Spongilla(fresh water sponge)
- Symmetry: - They are **asymmetrical.,** Level of organisation:**-Cellular**
- Germ layer:-**Diploblastic**
- **Canal system:-**In sponges, the gathering of food, respiration and excretion and sperm transfer occurs through water canal system.
- Nutrition:-It is intracellular.Endoskeleton:-It is made up of siliceous or calcareous specule's and sponging fiber.
- Development: - **Development is indirect** includes a larval stage called **amphiblastula.**
- Reproduction:-Asexual:-Occurs by fragmentation and budding.
- Fertilization **is internal.**

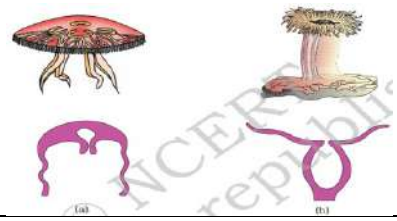
Ex-*Sycon* (*scypha), euspongia*(bath sponge), *Spongilla*(fresh water sponge)

Coelentrata

Habitat:-They are mostly Marine,Some are freshwater (hydra).

- **Polymorphism**: - The phenomenon in which the organisms occurs in two or more different forms with different structure and function.
- Cnidarians' are of two types:-
- Polyp: - Non–motile, cylindrical, can live solitary (singly) or colonial, reproduce asexually.Ex-Hydra.
- Medusa:-Free swimming, umbrella shaped, solitary and reproduce sexually.Ex- Jellyfish.
- Symmetry:- They have radial symmetry.
- Level of organization:-They have tissue level of organization.They are diploblastic.
- Skeleton:-It is made up of calcium carbonate.Ex-Corals.
- Digestive Tract:-Digestive tract is incomplete containing mouth but no anus. Mouth leads into a gastro vascular cavity or coelenterons which performs dual function i.e. partial digestion of food and the distribution to this partially digested food to gastro dermal cells.
- Digestion:-The digestion is partially intercellular and intracellular.
- Respiration and excretion occurs through general body surface.
- Reproduction:-In organisms like obelia and physalia which involves both polyp and medusa reproduce by met agenesis in which the polyp reproduce by asexually i.e. by budding or by regeneration and give rise to medusa and the medusa reproduce sexually and give rise to polyp again.This is known as Metagenesis in which a diploid multicellular phase alternate with other diploid multicellular phase.
- Fertilization may be internal or external.
- Development is indirect includes a free-swimming, ciliated larval stage planula.

Ex-Polyp- Hydra (freshwater polyp).Sea anemone (adamsia).Panatela (sea pen).Gorgonian (sea fan).Meandering (brain coral)Medusa-Aurelia (jellyfish).
Bath-Obelia, physalia.



Ctenophora

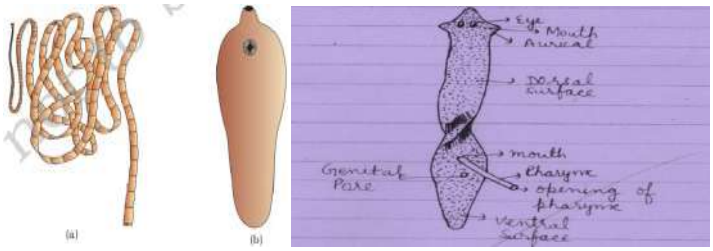
- Commonly called sea walnut or comb jellies.
- Habitat-Exclusively marine.Symmetry-Biradial symmetry.
- Level of organization –Tissue level.Germ layer-They are diploblastic.
- Locomotion- It occurs by light external rows of ciliated tract known as comb plates.
- Digestive tract-It is complete containing mouth that leads into pharynx and tow and pore.
- A central cavity forms the gut which is known as gastro vascular cavity which has a dual function i.e. the partial digestion of food and to gastro dermal cells.
- Respiration and Excretion-It occurs through general body surface.
- Reproduction-They are hermaphrodite but prefer cross fertilization.
- Fertilization is external.Development is indirect and includes a motile larva
- They show the property of bioluminescence.

Example- *Hormiphora* (sea walnut), *Ctenoplana, Pleurobrochia* (sea gooseberry).

Platyhelminthes

- Commonly known as flat worm.
- Habitat-They mostly lives as end parasite and the parasitic forms contain hook and sucker.
- Symmetry-They have bilateral symmetry.Level of organisation - Organ level.
- Germ layer – Triploblastic.Coelom-They are acoelomate.
- The anterior end of the body forms a small conical head which contain little brain and some sense organs.
- Digestive tract –It is incomplete i.e. it does not contain anus.Digestion of food is intercellular.Respiration occurs through general body surface.
  Excretion occurs through flame cells (proto nephridia) which leads into the excretory tubule and open out by excretory pore.
- Reproduction-They are hermaphrodite but prefer cross fertilization.
- Fertilization is internal.Some posses a high degree of regeneration.
- Development is indirect include many larval stages.

Example-*Taenia soliuom (*tape worm), *Fasciola* (liver fluke), *Schizostoma* (blood fluke), *Planaria*.

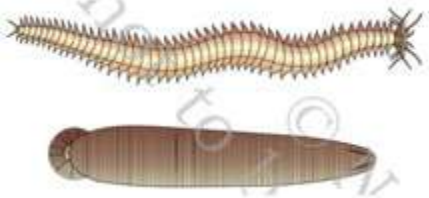


- Aschehelminthes Commonly known as roundworm.
- Habitat-Mostly endoparsite but may be free living.
- Germ layer-they are triploblastic.

Symmetry-they have bilateral symmetry.

- Coelom-They are pseudocoelomatls.,Level of organization-organ system level.
- Digestive tract-It is complete., Respiration occurs through general body surface.
- Execration is done by h-shaped intracellular canals.
- Reproduction-They are unisexual and the female is larger than male.
- The male has a copulatory organ.,Fertilization is internal.
- Development may be direct (ascaris)or direct(wuchereria)
- Example-*Ascaris* (round worm)-cause ascariasis in human, *Ancylostoma* (hook worm), *Wuchereria* Cause elephantiasis in humans.

Annelida



- Commonly known as segmented worm.

- Habitat- Aquatic.Ex-leech.Terrestrial. Ex-Nereis, earthworm.
- Level of organization- Organ system level.Symmetry- They are bilaterally symmetrical.
- Germ layer –They are triploblastic.Coelom-They are true cellmates.
- Metamerization-They whole body is divided into various segments called metamers.
- In some organisms the unjointed appendages called parapodia which help in locomotion. Ex- Nereis(sand worm)
- In some organisms locomotion occurs by the contraction and relaxation of longitudinal and circular muscles.Ex- Leech, Earthworm etc.
- Circulatory system-Circulatory system is closed and the heart is dorsal. Heart is present in more numbers.Ex- In earthworm four pairs of heart are present.
- Blood is red containing hemoglobin pigment.
- Respiration – Occurs through skin (Cutanlous respiration).
- Excretion-Occurs through coiled tubules called metanephridia.
- Reproduction- They are hermaphrodite (Earthworm, leech) or unisexual (nereis).
- Development-Mostly indirect including a larval stage trochophore larva
  Example-Nereis (Sandworm), Pheretima (Earthworm), Hirudinaria (leech).

Arthropoda

- Commonly known as animals with jointed bodies.
- Habitat-Aquatic (Freshwater, marine), Terrestrial.
- Symmetry- Symmetry is bilateral.
- Level of organization-Organ system level.
- Germ layer-Triploblastic.
- They are coelomates.
- Their body is mostly divided into three segments:-

1.Head 2.Thorax 3.Abdomen.

- All arthropods have jointed legs.
- Mostly there are three pairs of legs are present:-
- But in crustaceans and Arachnida more than three pairs of legs are present.
- **Body Wall**:- All segments are covered by chitinous plates (Sclerosis) made up of chitin sugar. **Digestive tract**:- It is complete &Digestion is intercellular
- The mouth is provided with various movable parts like labrum, labium, Mandibles, Maxillae e

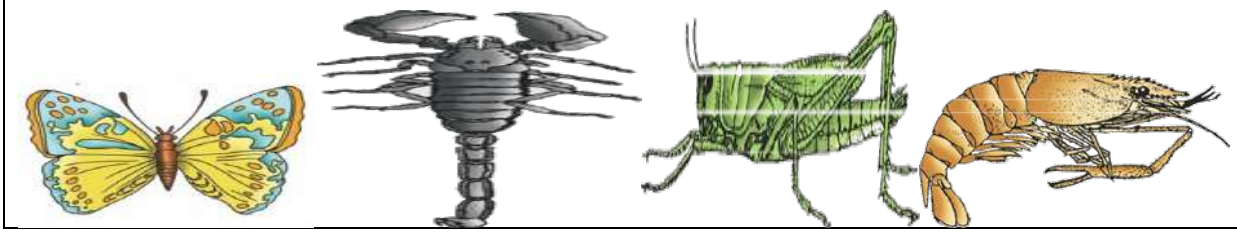
Class 1. Crustaceans: - Example: -Daphnia (water flea),Palaemon (Brown),Astacus (Cray fish) Cancer (Crab),Eupagurus (Hermit crab) Lucifer (shrimp).

- Class 2. Chilopoda:- .Example:- Scolopendra (centipede).
  Class 3. Diplopoda:- Example:- Jules - Millipedes.
  Class 4. Insecta: - Example:- Poecilocerus (Grasshopper),Periplaneta (Cockroach), Anopheles /Culex/ Aides' (Mosquitoes)
- Piers (Butterfly),Lepisma (Silver fish),Bombyx (Silk moth),Musca (House fly) Apes (Honey bee),Ants and termites.

Lac Insects (Lucifer):- The lace produced by these insects is used for making toys, varnishes, paints, polishes etc.

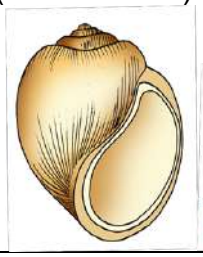
Class 5. Arachnida:- Example: - Palamnaeus (Scorpion),Aranea (Spider),Limulus (King Crab).

1. Reproduction: - Sexes are separate, Fertilization is mostly internal.
2. They are mostly oviparous.



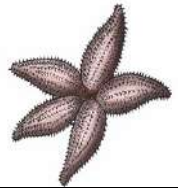
Mollusca

- Commonly known as soft bodied and shelled animals.
- Habitat: -Mostly aquatic (freshwater/ Marine),Few terrestrial (Moist soil).
- Symmetry: - 1. Bilateral in Cephalopods (Ex: - Octopus).
  2. Asymmetrical in gastropods (Ex:- snails).
- Germ layer: - They are triploblastic.Level of Organisation: - Organ system level.
- Coelom:- They are true coelomates.Shell: - It is non-cellular Calcium carbonate covering secreted by Mantle.Mantle: - It is a thin fleshy fold of dorsal body wall. It enclosed a cavity between the body and itself.
- Body is divided into three parts – head, visceral hump and muscular foot.
- Digestive tract: - It is complete. It has a rasping organ, Radula, which contains horny teeth.
- Respiration occurs through gills also called ctenidium.
- Circulatory system: - It is.Blood is blue due to the presence of a blue colored copper containing pigment known as haemocyanin.
- Excretion occurs through one or more sac like kidney.
- Reproduction:- Sexes are separate,They are oviparous.Fertilization is internal (Gastropods) or external (cephalopods).
- Development is indirect includes a larval stage Glochidium.
- Examples :-Gastropods:- Pila (Apple Snail), Aplysia (Sea hore),Pinctada (Pearl Oyster),Dentalium (Tusk cell),Chaetopleura (Chit on)Cephalopods: Sepia (Cattle fish), Lalagos (the squid), Octopus (the devil fish).



Echinodermata.

- Commonly known as spiny-skinned animals.
- Habitat:- They are exclusively marine.Symmetry:- Bilateral symmetry in larva but radial symmetry in adult.Germs layer:- Triploblastic.
- Level of organization:- Organ system level.
- Enterocoelom is present. It is true coelom in which coelom develop from gut. At larval stage the part of coelom is modified into a water filled ambulacral or water vascular system, which help in food capturing, respiration, distribution, excretion and locomotion.
- Digestive tract:- It is complete but incomplete in brittle star (ophiothrix). Mouth is present on ventral side known as oral surface and Anus is present on dorsal surface known as aboral surface.
- Respiration occurs through gills called dermal bronchi.
- Circulatory System:- It is highly reduced and is of open typeHeart and respiratory pigments are absent.
- Reproduction:- Sexes are separate, Fertilization is external.
- Development is indirect includes a motile larva, bipinnaria.
- Example:- Asterias (Star fish),Ophiothrix (Brittle Star),Echinus (Sea Urchin)
  Anted on (Sea lily, feather star),Cucumaria (Sea Cucumber)



Hemichordata

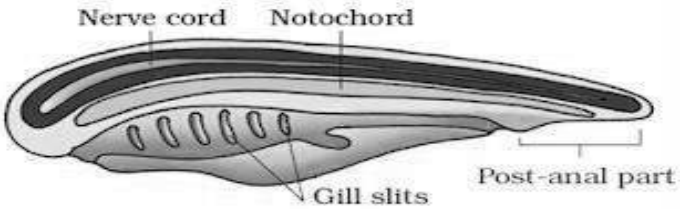
Commonly known as half chordates.

- Earlier placed as a sub-phylum in chordates but after that placed into non-chordates.
- Habitat:- Exclusively marine.
- Symmetry:- Bilateral symmetry.
- Level of organization:- Organ system level.
- Germ layer:- Triploblastic.
- Coelom:- True coelomates.
- Body is divided into three regions – proboscis, collar and trunk.
- Digestive tract:- It is complete and proboscis contain a hollow outgrowth from the gut.
- Respiration:- It takes place through gills.
- Circulatory system:- It is open and include a dorsal heart to longitudinal vessels.
- Blood is colorless with corpuscles.
- Nervous system:- It is of diffused type and consists of only epidermal nerve cell and nerve fibre.Excretion:- It occurs by a proboscis gland.
- Reproduction:- Sexes are separate.
- Fertilization is internal.
- Development is indirect includes a free swimming larva, Ex., balanoglossus

PHYLUM -CHORDATA

Diagnostic Character:-

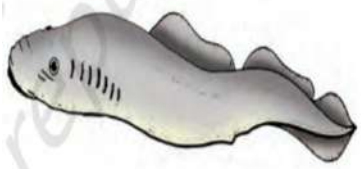
- Single, dorsal, hollow, nerve cord.
- A solid mid dorsal unjointed notochord.
- Paired pharyngeal gill slits
- Muscular tail.



Chordata characteristics (Body plan)

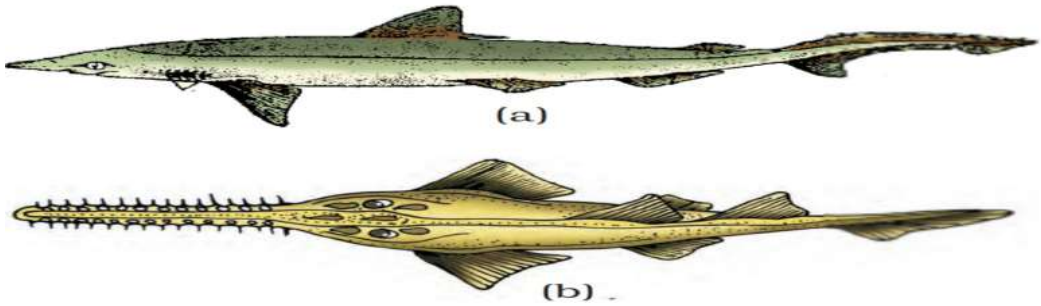
Phylum chordates has three Subphylum

SUB-PHYLUM UROCHORDATA	
Figure 4.17 *Ascidia*	• Commonly known as tunicates and ascidians. • Habitat:- Exclusively marine.Non- motile, filter feeding chordates. • Notochord occurs only in the tail of larva and disappears in adult. • The nerve chord is present which is single, dorsal and hollow in larva but it is replaced by a single dorsal ganglion. • The tail is mostly present in the larval stage. • The body is covered by a leathery test or tunic which is made up of cellulose like material. • The pharyngeal gills slits are numerous and present in both larva and adult. • Development is indirect that include a more chordate like larva called tadpole which is changed into less chordate like adult. Such metamorphosis is known as retrogressive metamorphosis. Example:- Herd mania (Sea squirt) , Doliolum, Salpa, Ascidia
SUB-PHYLUM CEPHALOCHORDATA	
	• Notochord extend form tip of snout to tail and persist throughout life. • The dorsal hollow nerve cord also persists throughout life.

	• A paired pharyngeal gills slits are present and persist up to adult. • A tail persists throughout life. • They lives in burrows and are filter feeder. • Example: - Brachiostoma/ Amphioxus (Lancelet).
SUB-PHYLUM VERTEBRATA **Class cyclostomata**  **Figure 4.18** A jawless vertebrate - *Petromyzon*	Class Cyclostomata:- • Jawless vertebrates. • Habitat:- Exclusively marine and lives in burrows. • They are most primitive vertebrates. • They have unpaired fins.Skeleton:- There is no exoskeleton but the endoskeleton is made up of cartilage. • Digestive system:- Mouth is circular and sartorial type. • Tongue forms horny teeth. • Air bladder is absent.Buoyancy is provided by liver. • Respiratory system:- It includes 5 to 16 pharyngeal gills. • Circulatory system:- Heart is two chambered involving two auricle and two ventricle. Additional chamber sinus venous is present but cones arteriosus is absent. • RBCs are circular and nucleated. • Circulatory system is closed. • Nervous system:- It includes 8 to 10 pairs of cranial nerves. • Sense Organs:- It includes olfactory sac, a pair of eye, only internal ear (Membranous labyrinth us) are present. • Reproductive system:- Fertilization is external gonads are single. • Development:- Indirect and include a free-swimming filter-feeding larva called ammocoetes. • They are cold-blooded (Poikilothermy). • Example:- Maxine (Hag fish), petromyzon (lampreys).

CLASSES OF VERTEBRATES

SUPER CLASS – PISCES:-**Class Chondrichthyes:-**



- Commonly known as cartilage fish.
- Habitat:- Aquatic – Marine or freshwater.
- Appendages:- There are eight number of fins present, as follows:- Caudal fin is unsymmetrical.
- Skin:- It has unicellular epidermal gland that release slimy mucus.
- Exoskeleton:- The skin has dermal placid scales.Endoskeleton:- It is made up of cartilage.
- Digestive system:- Mouth is ventral and teeth are modified placoid scales.
- Alimentary Canal:- It open by the cloacae.Body form:- It has streamlined body.
- Respiratory system:- It occurs by 5-7 pairs of gills. Gills are not covered with operculum.
- Swim bladder is absent but a large amount of oil is stored in a huge liver to provide buoyancy.

- Excretory system:- Excretion occurs by kidney

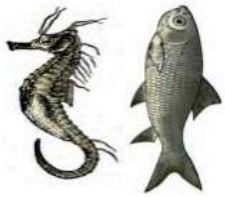
Circulatory system:- Heart is two chambered including one auricle and one ventricle

- RBCs are oval, biconvex and nucleated.
- Cranial nerves:- 10 pairs of cranial nerves are present.
- Reproductive system:- Sexes are separate. Reproductive duct open into cloaca.
- Fertilization is internal, Mostly Viviparous, Development is direct.
- Example:- Scoliodon (Dog fish, Indian shark), Pristis (Saw fish), Carcharodon (great white shark), torpedo (Electric ray), Tryon (Sting ray), Chimera (Rabbit fish).

- **Class – Osteichthyes** Commonly known as bony fish.
- Habitat:- Aquatic (freshwater or marine).
- Appendages:- They includes fins which are seven in numbers.

One dorsal fin,Two pectoral fins,Two pelvic fins,One anal fin,One median caudal fin, Caudal fin is symmetrical.

- Skin has unicellular epidermal glands that release slimy mucus.
- Exoskeleton:- The skin has cycloid and steroid scales.
- Endoskeleton:- Endoskeleton is made up of Digestive system:- Mouth is median.
- Body is streamlined.
- Respiratory system:- Gills are covered by operculum Swim bladder or air bladder:- Gas filled swim bladder are present to provide buoyancy.
- Excretory system:- Excretion occurs by kidney.
- Circulatory system:- Heart is two chambered including one auricle and one ventricle.
- RBC is biconvex and nucleated.
- Nervous system: - 10 pairs of cranial nerves present.
- Sense organs include a pair of eye, a pair of olfactory sacs and internal ears.
- Reproductive duct do not open in cloacae.
- Fertilization is external, they are oviparous, and Development Example:-Exocoetus (Flying fish),Clarias (Cat fish),Catla catla (Carp),Protopterus (African lung fish), Aquarium- Betta



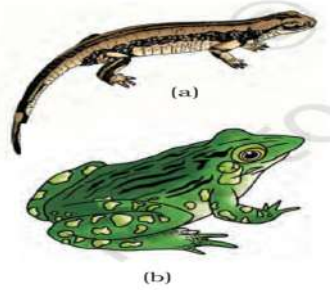
SUPER-CLASS TETRAPODA

Class Amphibia

- Commonly called Animals with dual life.
- Habitat:- Terrestial as well as aquatic.
- Body form:- Body is divided into head, trunk and tail or Head and trunk.
- Appendages:- Two pairs of pentadactyl limbs each with 3-5 digits.
- Tail may be present in some cases.Skin:- It is smooth and moist.
- Exoskeleton (scales) are absent.Endoskeleton is made up of bones.
- Digestive system:- Teeth are homodont and acrodont.
- Alimentary canal leads into cloaca.
- Respiratory system:- It occurs through gills at larval stage. (Bronchial respiration).
- It occurs by lungs in adult in air (Pulmonary respiration).
- Occurs through buccopharyngeal cavity (Buccophryngeal respiration).
- Occurs through skin. (Coetaneous Respiration).
- Circulatory system:- The heart is three chambered containing two auricle and one ventricle.
- RBCs are oval, biconvex and nucleated.
- Cranial Nerves:- There are 10 pairs of cranial nerves.

-
- Sense organs:- A pair of olfactory sacs that communicate with buccopharyngeal cavity, a pair of eye which have eyelids. Middle ear contains only one bone in addition to internal ear. External ear is absent.
- Excretory system:- Urethras enter into the cloacae.Urinary bladdes is present.
- Reproductive system:- Gonoducts open into the cloaca.
- Fertilization is mostly external,They are mostly oviparous.
- Development is indirect including tadpole larva.
- They are cold-blooded animals (Poikilothermic).

Examples:- Rana Tigrigna, Bufo (toad), Salanadra. Ichthyophis (Coecilian), Alytes (Mid-Wife toad)

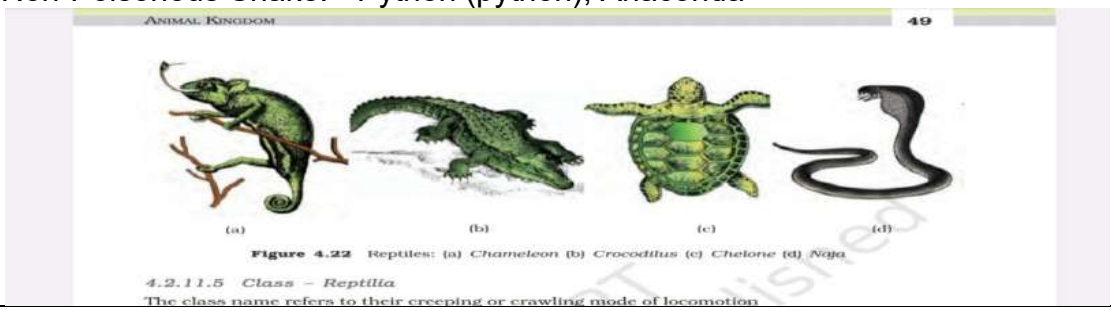


Class Reptilia

Commonly called creeping vertebrates.

- It is divided into head, neck, trunk and tail.
- Appendages:- Two pairs of pent dactyl limbs each ends into five digits and forms horny claws.Skin is rough and dry. The skin is periodically sloughed off from the body and the process is known as molting.
- Exoskeleton:- It is made up of epidermal scales.Endoskeleton:- It is made up of bones.
- Digestive system:- Mouth is large and consists teeth in both jaws liver and pancreas are present. Alimentary canal opens into cloacae.
- Respiratory system:- Respiration occurs by lungs. Gills are completely absent.
- Circulatory system:- Heart is incomplete four chambered with two auricles and one partially divided ventricle but in crocodile the heart is completely four chambered.
- Cranial nerves:- There are 12 pairs of cranial nerves.
- Excretory system:- Kidneys are metanephric.
- Reproductive system:- Fertilization is internal.They are mostly oviparous.
- Development is direct.
- Examples:-Chelone (Turtle), Testudo (Tortoise), Chameleon (Tree lizard), Calottes (garden lizard), Draco (flying lizard), Hemidactylus (wall lizard).
- Crocodiles (Crocodile), Gavial is (Gabriel), Alligator (Alligator).
- Poisonous Snake:- Naja (Cobra), Bangers (Krait), Viper a (Viper).

Non-Poisonous Snake: - Python (python), Anaconda


ANIMAL KINGDOM 49

(a) (b) (c) (d)

Figure 4.22 Reptiles: (a) *Chameleon* (b) *Crocodilus* (c) *Chelone* (d) *Naja*

4.2.11.5 Class – Reptilia

The class name refers to their creeping or crawling mode of locomotion

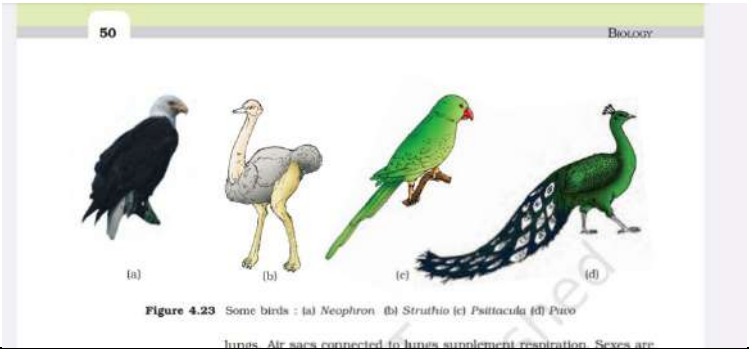
Class Aves

- Commonly called birds.
- Habitat:- Mostly terrestrial.Body form:- They have streamlined body and is divided into head, neck, trunk and tail.
- Appendages:- Two pairs of limbs are present Forelimbs are modified into clings for flight.
- Skin:- The skin is thin and dry except for oil gland or preen gland on tail.
- Exoskeleton:- It is made up of feathers.Endoskeleton:- It is made up of bones and the long bones are hollow (pneumatic bones) and have air cavity. jaws are modified into horny beak, containing no teeth.
- Digestive tract:- Mouth has a wide gap. Teeth are absent.
- Alimentary canal has additional chamber crop and gizzard. Crop stores and softens the food. Alimentary canal opens into cloaca.
- Respiratory system:- It occurs by lungs, Larynx does not act as sound producing organ because voice box is absent. The voice box is present at the junction of division of Trachea. It is called syrinx.
- Circulatory system:- Heart is four- chambered having two auricles and two ventricles. Accessory chambers are absent.
- Excretory system:- It occurs through kidneys and urine is semi- solid. Urinary bladder is absent.
- Reproduction system:- Right gonads and gonoducts are absent.
- Fertilization is internal. All are oviparous. Development is direct
- They are warm- blooded animals (Homoeothermic).

Example:- Carves (crow), Columba (pigeon), Psittacula (parrot), struthio (ostrich), Pave (peacock), Aptenodytes (penguin), Neoprene (vulture), Archaeopteryx (Lizard bird).

<u>Some flight adaptations of birds</u>:-

- Pneumatic bones, and contains air cavity
- Streamlined body.
- Forelimbs are modified into wings.
- Flight muscles attached to sternum.
- Heart beats fast for quick supply of oxygenated blood.
- Jaws are modified into horny beaks.
- Right gonads and gonducts are absent.
- There is no urinary bladder.



Class Mammalia

- Habitat:-Aquatic, terrestrial and air.
- Appendages:- Two pairs of pent dactyl lobs are present.
- Skin:- It is dry and rough. It contains multicellular glands like sweat gland Oil gland (sebaceous), wax gland
- Exoskeleton:- It is made up of hairs.
- Endoskeleton:- It is made up of bones. Atlas and Axial are the first vertebrae for the movement of head.

- Digestive tract:- Teeth are heterodont (different types of teeth are present in the jaws), Thécodont (teeth develops in socket) and Diphyodont (Teeth occurs in two sets- milk teeth and temporary teeth).
- Tongue is highly flexible and muscular.
- Liver and pancreas are well developed.Alimentary canals open out by anus.
- Respiratory system:- Respiration occurs through lungs. Ribs muscles and diaphragm also help in breathing.Excretory system:- Excretion occurs through kidneys. They are ureotelic. Urethras open into urinary bladder.
- Circulatory system:- Heart is four chambered with two auricles and two ventricles. Additional chambers are absent.
- Nervous system:- 12 Pairs of cranial nerves are present.
- Reproductive system:- Sexes are separate,Fertilization is internal.
- They are viviparous, Development is direct.They are warm blooded animals (Homoeothermic).
- Examples:-Oviparous Mammals (Prototherian Mammals):- Ornithorhynchus (Duck-Billed platypus), Tachyglossus (Spiny Ant eater). Viviparous Mammals (Lutheran Mammals):- Microbus (kangaroo), pteropus (flying fox), Balaenoptera (blue whole), dolphins, Canis (dog), Felix (cat), panthera Leo (lion), panthera tigris (tiger), Panthera pardus (leopard), camelus (camel), Alphas (Elephant), Aqueous (horse).

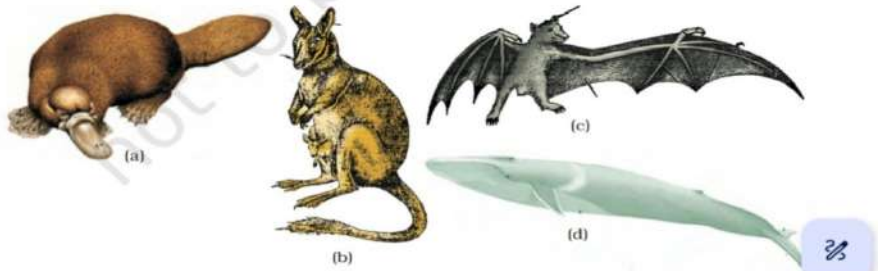


Figure 4.24 Some mammals : (a) *Ornithorhynchus* (b) *Macropus* (c) *Pteropus* (d) *Balaenoptera*

QUESTION BANK

MULTIPLE CHOICE QUESTIONS

1- What is the highest level of organization in animals.

a- Cellular Level b- Tissue level c- Organ level d- None of these

2- Which phylum belongs to pseudocoelomate-

a- Coelenterate s b- Aschelminths c- Arthropoda d- Vertebrates

3- What is the role of the water canal system in Porifera-

a- Food gathering b- Respiratory exchange c- Removal of wastes d- All of these

4. In case of poriferans, the Spongocoel is lined with flagellated cells called

a) Ostia b) Oscula c) Choanocytes d) mesenchymal cells

ASSERTION AND REASON QUESTIONS

6. Assertion: Tapeworm, roundworm and pinworm are endo-parasites of human intestine.
   Reason: Improperly cooked food is the source of intestinal infections.
7. Assertion: In ctenophores, digestion is chiefly extracellular.
   Reason: Digestive tract is incomplete in ctenophores.
8. Assertion: Arthropods are able to survive in adverse conditions.
   Reason: Arthropods have developed sense organs, compound eyes and taste receptors.
9. Assertion: Water vascular system is the characteristic of echinoderms.
   Reason:Main function of water vascular system is locomotion.

10- Assertion: In hermaphrodites, the sexes are not separate.
Reason: eggs and sperm are produced by the same individuals.

1	2	3	4	5	6	7	8	9	10
C	B	D	C	B	B	A	D	B	B

Very short answer question

1..In Porifera and Annelida the symmetry observed are---------- and ---------- respectively.
Ans: Porifera- asymmetrical, Annelida- bilateral symmetry

2.The head, muscular foot, and visceral hump are the property of which phylum.
Ans: Mollusca
3.Name two animals that belong to hemichordate.
Ans: Balanoglossus and Sacchyglossus.
2- Mention the body cavity type found in Platyhelminthes, Aschelminths, and Echinodermata.
Ans: Platyhelminthes (acoelomate), Aschelminths (pseudocoelomate), Echinodermata (coelomate)
4- What are polyps and medusa?
Ans: Polyps and medusas are both types of jellyfish, belonging to the same phylum – Cnidaria. Polyps are typically stationery and medusas are generally free-swimming.
5- Which structures help in the movement of annelids?
Ans: longitudinal and circular muscles and parapodia.
Short answer type questions
1.(i)Explain Protochordates.
(ii) How presence of notochord differs in Protochordates?
2.Define metamerism. Give the name of one phylum which shows this property.
3.Explain any four types of excretory systems in animals by citing examples of each.
4.Describe class – Chondrichthyes by giving three peculiar features and two examples of s – Chondrichthyes
5.Write the importance of the tympanum, cloaca, air bladder, and radula.
Examples: Pleurobrachia and Ctenoplana.
Competency based questions
1**.** The animal kingdom is full of amazing creatures. This marine organism shows bioluminescence and is transparent in appearance.
a) To which phylum does the above-mentioned organism belongs?
b) Mention any two other characteristics of this phylum.
Ans. a) Ctenophora
b) **Comb plate:** eight rows of ciliated plates for locomotion, body is radially symmetrical
2..How do endo-parasites survive inside the body of the host?
3. Provide a technical term for the following:
a) Blood filled cavity in arthropods b) A stinging organ of jellyfish c) Free-floating form of Cnidaria d) Lateral appendages in aquatic annelids e) Osmoregulation and excretion f) Cold blooded animals
4: How important is the presence of air bladder in Pisces?
CASE BASED QUESTION
1.Read the following and answer the questions given below:
Aadhya, a student of class IX has brought a crab and an apple snail from the beach. She had identified both as members of Phylum Mollusca, as they have a shell. As a senior student of biology, help her to identify the animals correctly.
(a) Name the phylum, crab belongs to and that which apple snail belongs to.
(b) Write any four differences between the animals of the two phyla.
(c) Name any two economically important arthropods.
Long answer questions
1. Give a brief account on-

- (i) Respiration of porifera, Arthropoda, Mollusca, Echinodermata and Cyclostomata of animal kingdom.
- (ii) Excretory system of Porifera, Arthropoda, Hemichordata, Platyhelminthes, and Annelid

2- List the adaptive features of birds.

CHAPTER-5: MORPHOLOGY OF FLOWERING PLANTS

Morphology:- It is a branch of biology which deals with external characteristics of organism.

Parts of a Typical angiosperm

ROOT
It is typical non-green underground descending part of a plant that gives lateral branches and keeps the plant erect.
Characteristics:- 1. Non-green and non photosynthetic. 2. Descending and underground. 3. Nodes and internodes are absent. 4. It possesses unicellular root hair for absorption. 5. Positively geotropic, hydrotropic but negatively phototropic.

Parts of Root				
Root Cap	Zone of cell division	Zone of elongation	Root hair zone	Zone of Maturation
The apex of root is covered by a thimble like structure called root cap. It protects the apex of root and makes its way as the root is continuously growing downwards	It is the small region that is present few mm above the root cap. The cells of this zone continuously divide and add more and more cells to the elongation zone and root cap. These cells have dense protoplasm	This zone is present just behind the meristematic zones whose cells does not divide but undergoes rapid elongation and enlargement which cause growth in roots	It is the zone of maturation where a large number of unicellular root hairs are present.	It is the uppermost region of root where the cells neither divide nor elongate but only mature.

Types of Root System		
Tap root System	Fibrous root System	Adventitious Root System
There is a main primary root (Principle root) which gives further branches as secondary and tertiary etc. In this root system the radical initially remains undivided. Example: - All decoct plants – Mustard, Mango, See sham etc.	In this type of root system the primary root is short lived as the radical is divided in the beginning and forms the large number of fiber like roots.	In this type of root system the roots arise from the plant parts other than radical. Example: - Banyan tree, Sugarcane, Maize, Grasses.

STEM
It is the main ascending erect axis of the plant which develop from plumage and epicotyls of the embryo
Characteristics:

It is generally erect and grows away from the soil. So, that is positively prototroph ic and negatively hydrotropic and geotropic.
It posses nodes and internodes.
It forms various lateral appendages like leaves, branches, buds, flower etc. It also forms terminal buds.
Young stem is green and photosynthetic while old one is non-green.
Hair if born on the stem is generally multicellular.Lateral branches are exogenous

Function of stem

i. Perrenation - Helps plants to survive in unfavorable conditions as it store food for plant.
ii. Help in vegetative propagation.
iii. Help plant to protect from herbivorous animals by growing different structures.

LEAF

It is a thin, green, flat dorsiventral lateral and aerial part of a plant which is mostly involved in photosynthesis.

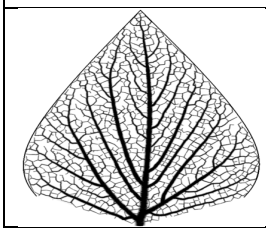
Characteristics of leaf:-

i. Always born on the node of stem.
ii. In most cases there is an auxiliary bud in the axial of leaf.
iii. It is exogenous in origin and develops from leaf prim odium (Meristmatic tissue of leaf).
iv. It is green and performs photosynthesis.
v. Each leaf has three main parts:-
a. Leaf base (hypo podium). B.Petiole (Mosopodium)
b. Leaf lamina (Epipodium).

- The dicot leaf is known as dorsiventral leaf because it's dorsal and ventral surfaces is different and contains stomata in more numbers on lower surface.
- The monocot leaf is known as isobilateral leaf as it contains equal number of stomata on both surfaces.

Leaf Venation

The distribution of veins and vein lets on leaf lamina is called leaf venation.It is of two types

Reticulate venation	Parallel Venation
The vein lets are irregularly distributed and forms a network called reticulate venation. Most decocts have reticulate venation. Ex:-Ficus, Mango (Magnifier indicia), Cucurbit a, Mulberry, Vitas viniferous, Papaya etc	In this all the vein lets run parallel to each other and don't form a network. Most monocots have parallel venation. Ex: - Banana, Cannae, Wheat, rice, millets, sugarcane, fan palm (Brasses), Bamboo, grasses etc.
	

Types of Leaves:-

1. Simple Leaves:- The leaves having a single lamia are called simple leaves. A simple leaf always contains a bud into its axial.
Ex:-Peepal, Focus, Mango etc.

2. Compound leaf:- A leaf is called compound when the incisions of lamina reach up to the midrib and breaks into a number of leaflets. A leaflet doesn't contain any bud into its axial.

Types of Compound leaf:-

i. Pinnate Compound leaves:- The midrib also called rachis forms a number of leaflets.

ii. Palmate Compound leaves:- When the two or more leaflets are attached at a common point i.e. at the tip of petiole.

INFLORESCENCE	
The arrangement of flowers on inflorescence axis or peduncle that is connected to the stem is known as inflorescence. Peduncle: - Main axis of inflorescence. Acropetal succession:- The new flowers arise on apex and mature flowers present on the base. Centripetal succession:- The younger flower at centre and older at periphery. Basipetal succession:- Younger flower at the base and mature are present at the apex. Centrifugal succession:-The mature flowers are present at the centre while the yougerflower are present at the periphery.	
TYPES OF INFLORESENCE	
Simple Racemose Inflorescence	Cymose Inflorescence
The type of racemose inflorescence in which peduncle remains unbranched. The flowers arise in either acropetal or centrepetal succession.	The peduncle (Main axis) is terminated into flower and further flowering occurs by the lateral branches below the terminal flowers. The arrangement of flower is either basipetal or centrifugal.

Taxonomy of flowers

Floral Symmetry:-

a. Actinomorphic (⊕) - Flowers which have radial symmetry.
   Ex:- Mustard, Dhatura, chilli, Hibiscus, seclanum etc.
b. Zygomorphic (%) – A flower which have bilateral symmetry.
   Ex:-Pisumsativum (all other varieties of pea) gulmohar bean, Cassia.
c. Asymmetrical :- A flower which is unsymmetrical.
   Ex:- Canna.

Number of floral parts:-

The occurrence of same number of floral parts is known as isomer and having the different number of floral parts is known as heteromery.

Types of isomer-

a. Demetrius:- Floral parts are two or multiple of two.
b. Timorous:- Floral parts are three or multiple of three.
c. Tetramerous:- Floral parts are four or multiple of four.
d. Pentamerous:- Floral parts are five or multiple of five.

Bract and Bracteole:-

Flower		
Unisexual: one type of sex organ either male or female		Bisexual: which contain both gymnasium as well as Androcium
Staminate flower	Pistillate flower	Stigma, style and ovary combine to form pistil, carpel or gymnasium.

Anther and filament of all stamens combine to form androeccium.

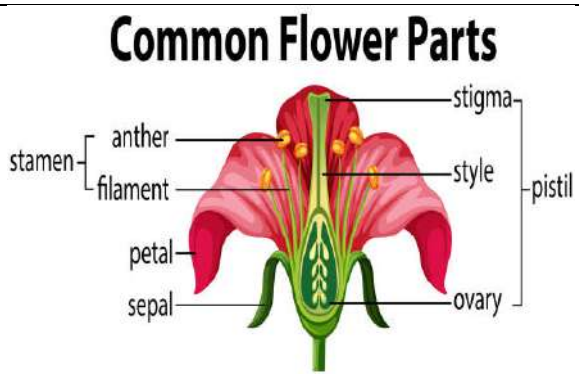
- All sepals are collectively called calyx.
- All petals are collectively called corolla.

Calyx (K):- Polysepalous – When sepals free Rose, tomato, chilies etc.

Gamosepalous- When sepals are joined together -Dhatura.

Corolla © - Polypetalous- Petals are free. Ex:- Rose, Mustard, China, rose etc.

Gamopetalous- Petals are fused in whorls or in parts.



Aestivation:- The mode of arrangement of petals in relation to one another in a flower is known as aestivation.

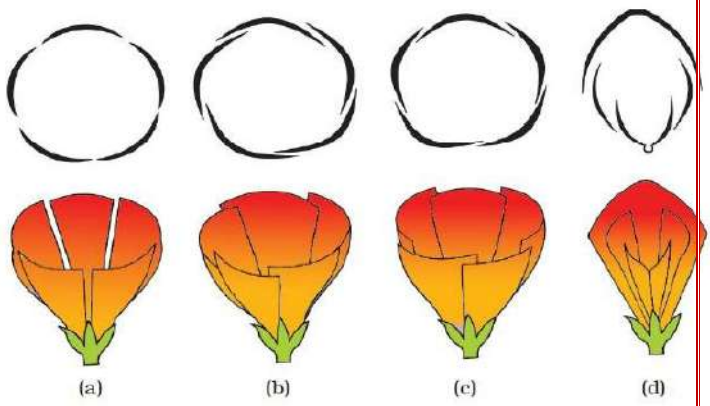
i. Valvate:- The petals of worls meet by their edges or margins but donot overlap.e.g.Calatropis.

ii. Twisted:- The margins of petals are overlapped in regular manner.e.g. (Lady finger).

iii. Imbricate:- The margins of petals are overlapped but in irregular manner.e.g. Cassia, Gulmohar.

iv.Vaxillary:- Total five petals are present Dorsal one (called standard) is largest. Two are lateral called the wings. Ventral ones are smallest called keel.

Ex: - Pea and bean (Family papilionaceae).



Perianth (P):-In some flowers, there is no distinction between sepals and petals. Such floral parts are known as perianth (tepal).

Stamen:-

Cohesion of stamen: -Monoadelphous:- All the stamen of the flower are united in one bundle by the fusion of their filament.Ex: - Hibiscus.

Diadelphous: - All the stamen of the flower are united in two bundles by the fusion of their filament.Ex:- Pea (Pisumsativum).

Polyadelphous: - All the stamens are fused and forms more than two bundles. Ex:- Citrus

Synadndrus: - Anthers as well as filaments are fused.Ex:- Cucurbits, Luffa.

Polyandrous: - Stamens are indefinite and are free.Ex:- Ranunculus (butter cup).

Adhesion of stamens:-Epipetalous- When the stamens are attached to petals by their filament.

Gynoecium:-

1. Types of ovary on the basis of cohesion of carpel:-

Syncarpus:-When all the carpels are fused.Ex:- Hibiscus, mustard, tomato, lemon, cucurbita.

Apocarps:- When all the carpals are free.Ex:- Lotus, Rose, Ranunculus.

2. Types of ovary on the basis of position of calyx, corolla, androecium in reselect to stamen-

Hypogenous flower (Superior ovary):- Ovary occupies the highest position by the other floral parts situated below it.

Ex:- Mustard, Brinjal (Selenium melongena), China rose, citrus.

a. Epigynous flower (Inferior Ovary):- Margins of the thalamus grow upward enclosing the ovary completely. Ex:- Cucurbit

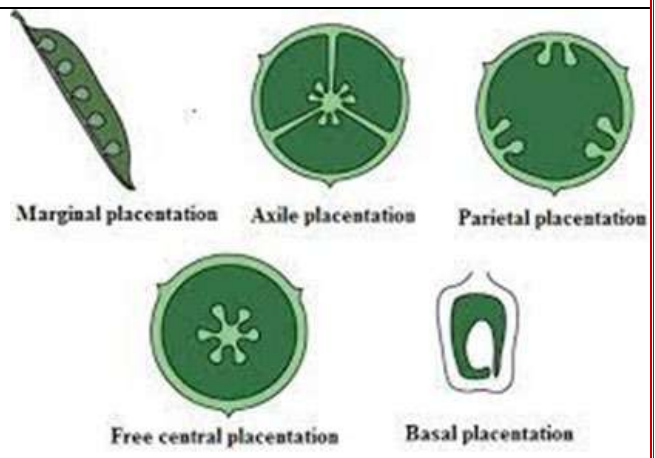
Perigynous flower:- If gynoccium is situated in the centre and other parts of flower are located on the rim of thalamus almost at the same level.Ex:- Pea, Rose, Prunes.

iii. No. of carpals and locules:-

a. Tricarpallarymonolocular:- Comprised of three carpals and ovary with one chamber.

b. Tricarpallarytrilocular:- Comprised of three carpals and ovary with three chambers.

c. Tetracapellary tetra ocular:- Comprised of four carpals and four chamber.

Placentation: -The arrangement of ovules in the ovary is called placenta ion. a. Marginal placentation:- . Ex:-Pisumsativum (Pea). b. Axial Placentation:- Ex:- Hibiscus, tomato, lemon etc. c. Parietal Placentation:-Ex:- Cucurbit (Cucumber, melon, water melon etc). d. Free central placentation:- Ex:- Dianthus, Primrose etc. e. Basal placentation:- Ex:-Asterceal (sunflower, marigold).	

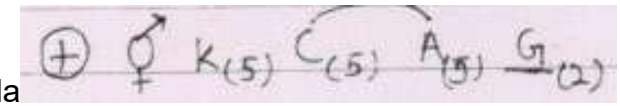
FRUIT:-It is a ripened ovary which is formed after fertilization.

Parthenocarphy:- The process of development of fruit without fertilization is known as parthenocarphy.

Pomology:- Study of fruits and it's cultivation.

SEED:-A seed is a ripened ovule formed after fertilization.

• Dicot seed (Non-endospermic, ex-aluminous). • It contains two cotyledons. • Endosperm is absent. • Ex: - Gram, almond, Pea, Apple, Mango, Orange, Coffee and groundnut.	• Monocot seed (Endospermic aluminous) • It contains one cotyledon. • Endosperm persists. • Function of scutellum. • It is a rudimentary cotyledon

Solanaceae:-Floral Formula 

Description of some important families:-

Solanaceae:-

Mostly herbs and shrubs but rarely small trees.

Stem:- Herbaceous rarely woody, aerial, erect, cylindrical, branched, solid or hollow, hairy or glabrous, underground stem in potato.

Leaves:- Alternate, simple, rarely, pinnately compound, exstipulate, reticulate venation.

Floral characters:-

Inflorescence:- Solitary, auxiliary or cymosely.

Flower:- Bisexual, Actinomorphic.

Calyx:- Sepals five, united, persistent, valuate aestivation.

Corolla:- Petals five, united, valuate aestivation.

Androecium:- Stamens five, epipetalous.

Gynoecium:-Bicorpellary, Syscarpus, superior ovary, binocular, Placenta ion Axial.

Fruit:- Berry or capsule.

Seeds:- Many and Endospermous.

Economic Importance:-

- Source of food (Potato, tomato, potato, brinjal).

- Spices (chilly)
- Medicine (Belladonna, ashwagandha).
- Fumigator (Tobacco).
- Ornamentals (Petunia).

1. Liliaceae:- Commonly called 'lily family'.

- Perennial herbs with underground bulbs/corms/rhizomes.

Leaves:-Mostly Basel, alternate, linear, estipulate with parallel venation.

Floral Characters:-

Inflorescence: - Solitary/cymosely, often umbellate clusters.

Flower:- Bisexual, Actinomorphic.

Perianth:-Tepal six (3+3), often united into tube, valuate aestivation.

Androecium:- Stamen six (3+3)

Gynoecium:-Tricarpellary, syncarpus, superior ovary, trilocular with man ovules, axial placenta ion.

Fruit:- Capsule, rarely berry.

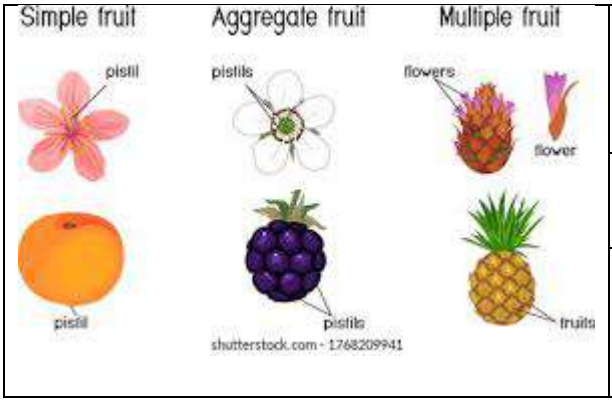
Seed:-Endospermous.

Economic Importance:-

Good ornamentals (Tulip, Glories).Source of Medicine (Aloe)Vegetable (Asparagus).Colchicines (Colchicum autumnal).

Fruits: The fruit is the characteristic feature of flowering plants, which is a ripened or mature ovary and the seed is what the ovules develop into after fertilization. The fruit that develops without fertilization is known as parthenocarpic.

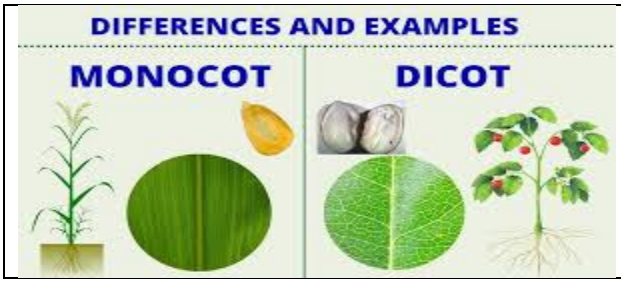
Types of Fruits

	1. Simple— Developed from the monocarpellary ovary or multicarpellary syncarpous ovary. Examples of simple fruits.
	2. Aggregate–Developed from the multicarpellary apocarpous ovary. Examples of aggregate fruits.
	3. Composite–These are false fruits, developed from the entire inflorescence rather than from single flower. Examples of composite fruits include blackberries, Raspberries strawberries, etc.

The Seed

A seed is a basic part of a plant, which is found enclosed within the fruit. It is made up of a seed coat and an embryo. During the development of the fruit, the wall of the ovary becomes the pericarp. In some plants, the ovary walls dry out completely, while in some it remains fleshy.

Types of Seeds Based on the number of cotyledons, seeds are further classified into two types- dicotyledonous and monocotyledonous seeds.	1. Monocotyledonous— The embryo consists of an embryo axis and has only one cotyledon. The monocotyledonous is also known as monocot seeds. Grains including rice, millet, wheat and other plants like onions, corn, ginger banana, palm tree, are examples of monocot seeds.
	2. Dicotyledonous— The embryo consists of an embryo axis and has two cotyledons. The dicotyledons are also known as dicots or dicot

	seeds. Legumes including beans, lentils, pea, peanuts, and tomato are examples of dicot seeds.

DESCRIPTION OF FAMILY SOLANACEAE It is a large family, commonly called as the 'potato family'. It is widely distributed in tropics, subtropics and even temperate zones.

 	A large family, commonly called as the 'potato family'. It is widely distributed in tropics, subtropics and even temperate zones. Vegetative Characters Plants mostly herbs, shrubs and rarely small trees Stem: herbaceous rarely woody, aerial; erect, cylindrical, branched, solid or hollow, hairy or glabrous, underground stem in potato (Solanum tuberosum) Leaves: alternate, simple, rarely pinnately compound, exstipulate; venation reticulate Floral Characters Inflorescence : Solitary, axillary or cymose as in Solanum

MCQS

1. Roots that grow from any other part of the plant other than the radicle are called
(a) taproots (b) adventitious roots (c) prop roots (d) epiphytic roots
ANS (b) adventitious roots
2. The roots that have swellings at regular intervals are called
(a) nodulose (b) fasciculated (c) moniliform (d) tuberous
ANS(c) moniliform
3. Massive aerial roots present in a Banyan tree is
(a) fibrous (b) respiratory (c) epiphytic (d) prop roots
ANS d) prop roots
4.. Plants growing in swamps have roots that grow vertically upwards like conical spikes and have aerating pores. Such roots are called
(a) pneumatophores (b) mycorrhizal (c) conical (d) assimilatory
ANS (a) pneumatophores

VERY SHORT ANSWER QUESTIONS

Q1. Reticulate venation is found in dicot leaves while in monocot leaves venation is of parallel type. Biology being a 'Science of exceptions', find out any exception to this generalization.
Ans: Smilax and Dioscorea are monocots having reticulate venation. Calophyllum and Eryngium aredicots having parallel venation.
Q4. Mango and coconut are 'drupe' type of fruits. In mango fleshy mesocarp is edible. What is theedible part of coconut? What does milk of tender coconut represent?
Ans: Edible part of coconut is endosperm or seed. Milk of tender coconut represent free nuclear liquid endosperm.

SHORT ANSWER QUESTIONS

Q1. A typical angiosperm flower consists of four floral parts. Give the names of the floral parts and their arrangements sequentially.
Q2.. How can you differentiate between free central and axile placentation?
Q3. The arrangements of ovules within the ovary is known as placentation. What does the term placenta refer to? Name and draw various types of placentations in the flower as seen in T.S. or V.S.

LONG ANSWER QUESTIONS

Q1. Describe the arrangement of floral members in relation to their insertion on the thalamus.
Q2. What is aestivation? What are its different types and give examples?

COMPETENCY BASED CASE STUDY QUESTIONS

1. Omprakash used to go to vegetable market with his grandfather, a retired biology teacher.Grandfather told Omprakash that chilies, brinjal and tomato belong to the same family of plants and asked him to find out similarity in these plants. Read the above passage and answer the followingquestions:-

I. Identify the family to which these plants belong.
II. What are the characteristic features of the family?
III. What value is reflected in grandfather's behavior?
Ans 1.
i. Solanaceae
ii. Persistant Calyx, Obliquely Placed Ovary and Swollen Placenta
iii. Grandfather wanted to arouse interest of his grandson in biology
2. Pointing towards a sunflower plant, father asked Kailash, a biology student to show him flower of this plant. Kailash pluck flowering twig and pointed towards the big yellow structure at the tip of the twig. Father laughed and clarified that it is not a single flower but a group of several flowers arranged in a disc like structure. Read the above passage and answer the following questions:-

I. What is inflorescence?
Ans .it is an axis bearing a cluster of flowers in a particular manner
II. Define racemose and cymose inflorescence?
Ans .in recemose type of inflorescence, the main axis possess terminal bud which grows indefinitely
giving rise to lateral and axillary flowers. In cymose type, the main axis terminates into a flowers and
further growth takes place by lateral branches which arises below the terminal flower.
III. What message is delivered by father of Kailash..
Ans Being a student of biology, one should observe things critically.
3. Ishwer was reading a chapter on function of different parts of a green plant. His mother asked him about the functions of roots. He replied that roots are meant for anchorage and absorbing water and minerals from soil. Then mother showed him radish, carrot and turnip and asked him about the additional functions that the roots perform. Read the above passage and answer the following

questions:- I. What is the special function of roots in above examples?
Ans storage of food
II. What other secondary functions roots are known to perform?
Ans support (Stilt root), respiration (pneumatophores), photosynthesis (Trapa).
III. What value is displayed by his mother.
Ans She enriched Ishwar's knowledge about secondary functions of root.

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CHAPTER: 6 ANATOMY OF FLOWERING PLANTS

Study of internal structure of plants/animals is called anatomy.

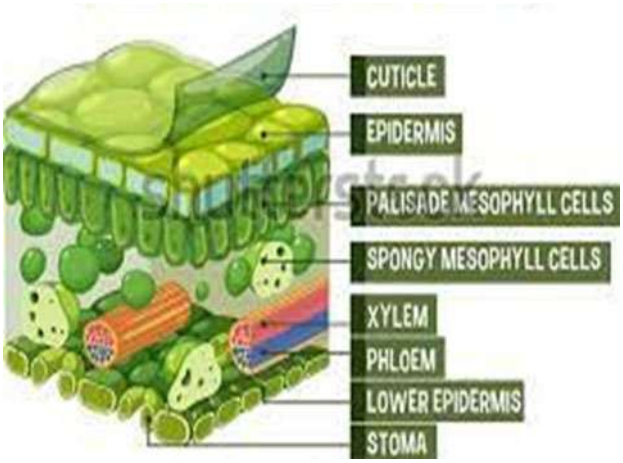
Plants have **cells**as the basic unit, cells are organized into **tissues** and in turn the tissues are organized into **organs**.
There are three types of tissue systems on the basis of their structure and location.
1. The epidermal tissue system 2. The ground or fundamental tissue system
3. The vascular or conducting tissue system.

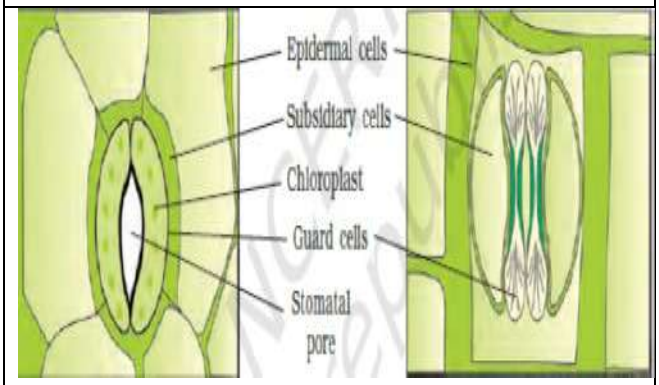
Epidermal Tissue System

Consists of Epidermal cells (The outermost single layer of cells)
Parenchymatous elongated and compact cells with a small amount of cytoplasm lining the cell wall and a large vacuole.
Presenceof waxy thick layer called the cuticle- it prevents the loss of water. Cuticle is absent in roots
Stomata (present in the epidermis of leaves)
Stomatal apparatus composed of two bean shaped cells known as guard cells which enclose stomatal pore.
Specialized cells known as subsidiary cells around guard cells. The outer walls of guard cells (away from the stomatal pore) are thin and the inner walls (towards the stomatal pore) are highly thickened
In grasses, the guard cells are dumb-bell shaped.

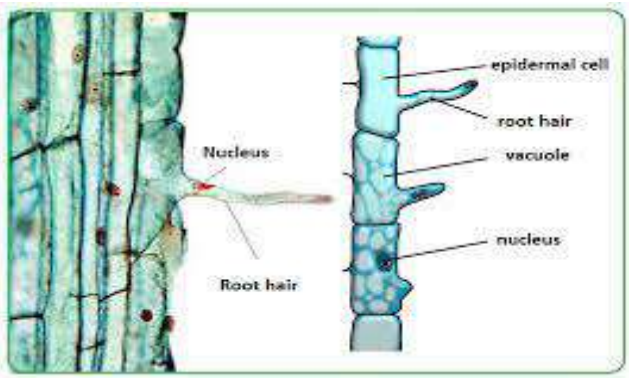
- Stomata regulate the process of transpiration and gaseous exchange.
- The guard cells possess chloroplastsand regulate the opening and closing of stomata.

Epidermal appendages-
Trichomes-
Multicellular epidermal hairs on the stem the are called trichomes.
They may be branched / unbranched, soft / stiff and may even be secretory.
The trichomes help in preventing water loss.
Root hairs : The root hairs are unicellular elongations of the epidermal cells
They help absorb water and minerals from the



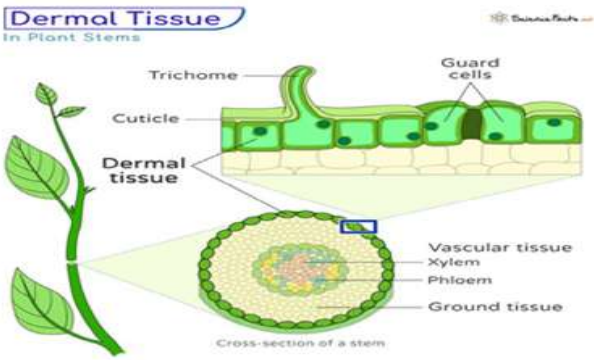


soil due to transpiration.



The ground or fundamental tissue system

All tissues except epidermis and vascular bundles
It consists of simple tissues such as parenchyma, collenchymas and sclerenchyma.



The vascular or conducting tissue system

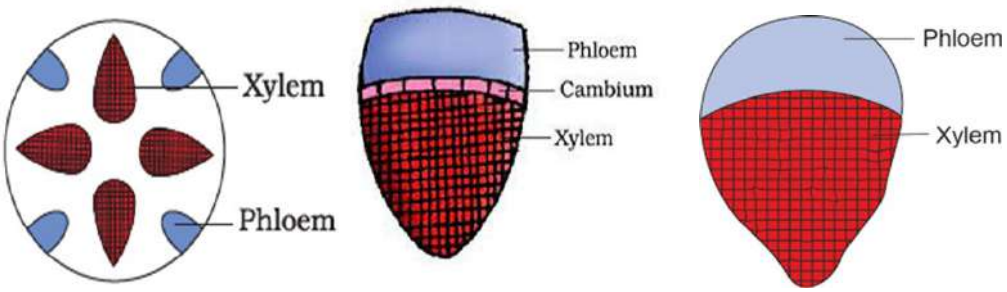
The vascular system consists of complex tissues, the phloem and the xylem.
The xylem and phloem together constitute vascular bundles.

Types of vascular bundles:

1. **Radial**- Xylem and Phloem tissues are arranged alternately along different radii (In Roots)
2. **Conjoint**— Xylem and Phloem are jointly situated along the same radius

2 types--i) **Conjoint open** ii) **Conjoint closed**

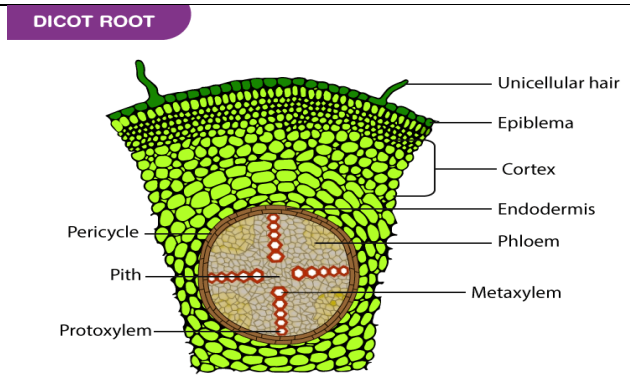
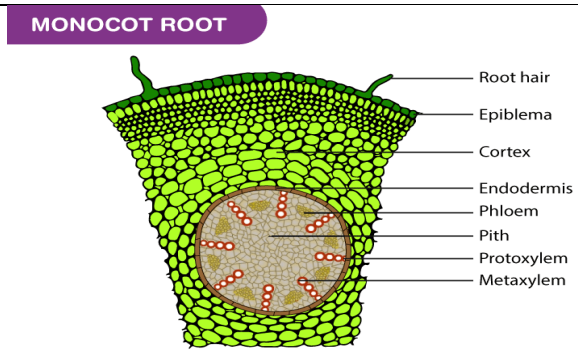
- Vascular bundles having cambium, possess the ability to form secondary xylem and phloem tissues, and hence are called open vascular bundles. (In Dicots)
- When the vascular bundles have no cambium present in them, they do not form secondary tissues and are referred to as closed. (In Monocots)



Radial conjoint open conjoint closed

- Anatomy of Dicot Root:-
- Epiblema -the outermost layer is.

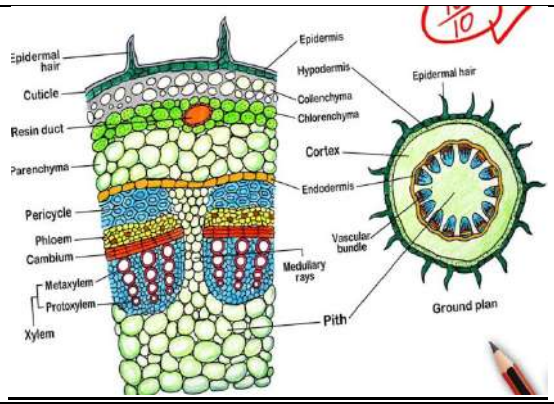
- Anatomy of Monocot Root:-
- The outermost layer is epidermis which

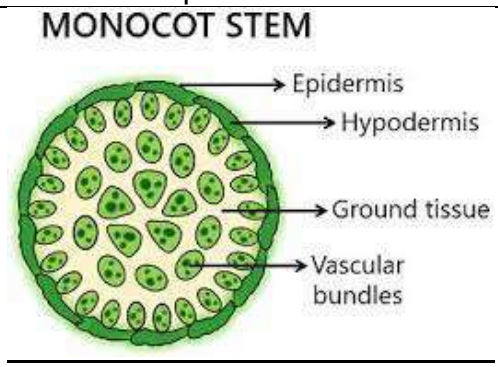
• The cortex-consists of several layers of thin-walled parenchyma cellswith intercellular spaces. • Endodermis-The innermost layer of the cortex with a single layer of barrel shaped cells without any intercellular spaces. • Casparian strips. The walls of the endodermal cells have adeposition of water-impermeable, waxy material suberin in the form of casparian strips. • Pericycle- Next to endodermis lies a few layersof thick-walled parenchymatous cells • There are usually two to four xylem and phloem patches. • The pith is small or inconspicuous. • Stele : All tissues on the innerside of the endodermis suchas pericycle, vascular bundles and pith constitute the stele.	forms unicellular root hairs. • Cortex consists of multilayered thin walled parenchymatous cells with intercellular space. • Endodermis:Innermost layer of cortex is known as endodermis. • casparian strips: It is also a single layer of barrel shaped cells without any intercellular spaces. The tangential as well as radial walls of endodermis have a deposition of water impermeable waxy substance made up of suberin. • Pericycle is present but it does not give rise to cambium. So that the secondary growth is absent. • These are usually more than six xylem and phloem patches. Such vascular bundle is known as polymorph. • Pith: - Pith is large and well developed.
	

Anatomy of Dicot Stem:- Epidermis: - the outermost protective layer of stem covered by a thin layer of cuticle. It may bear trachoma's and a few stomata. Cortex: - The cells arranged in multiple layers between epidermis and pericycle constitute cortex. It has three sub zones:- Hypodermis: - Consists of a few layers of collenchymatous cells just below the epidermis, which provide mechanical strength to the young stem. Cortical layers: - Present below hypodermis consists of rounded thin walled parenchymatous cells with conspicuous intercellular spaces.	Anatomy of Monocot Stem:- Monocot stem has a sclerenchymatous hypodermis. It has a large number of scattered vascular bundles. Vascular bundles are surrounded by a sclerenchymatousbundle sheath cells and a large conspicuous parenchymatous ground tissue. Vascular bundles are conjoint and closed. Peripheral vascular bundles are generally smaller than centrally located ones. Phloem parenchyma is absent and water filled calcites are present with vascular bundles.

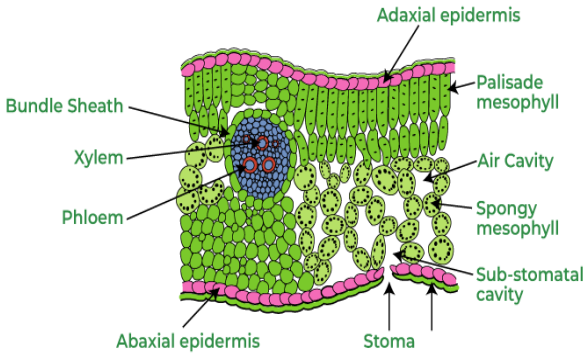
Endodermis: - It is the innermost layer of cortex.
Pericycle: -Pericycle is present on the inner side of the endodermis and above phloem in form of semi-lunar patches of sclerenchyma.

Vascular bundle: - A large number of vascular bundles are arranged in a ring, which is characteristic feature of decoct stem. Each vascular bundle is conjoint, open and with end arch protoxylem.
Pith: - A large numbers of rounded, parenchymatous cells with large intercellular spaces which occupy the central portion of the stem constitute pith.

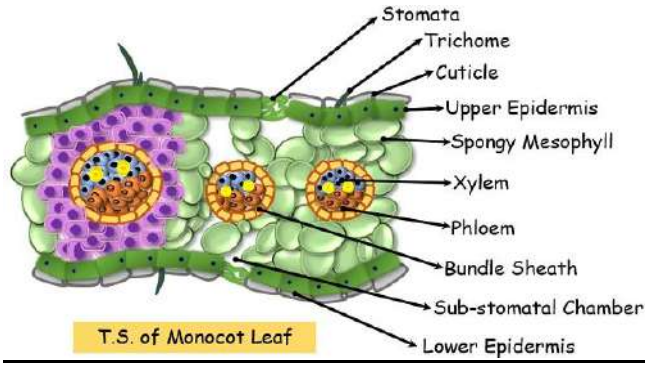




Anatomy of Dicot leaf(dorsiventral leaf)
Epidermal: - If covers both upper and lower surface. It is covered by a layer of cuticle.
The abaxial epidermis (upper) bears more stomata than abaxial epidermis (lower)
Sponge Parenchyma:- With large intercellular space. It is situated below palisade layer.
Vascular System:- It include vascular bundles, which can be stem in the veins of midrib. The sizes of vascular bundles are dependent on the size of veins. Vascular bundles are surrounded by a thick layer of bundle sheath cells.



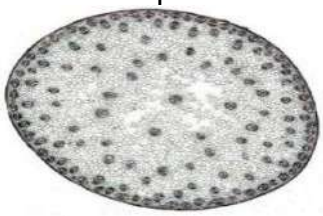
Anatomy of Monocot leaf (Isobilateral leaf)
Stomata are present on the both surfaces of the epidermis.
Mesophyll is not differentiated into palisade and spongy parenchyma.
In grasses, certain ad axial epidermal cells along the veins modify themselves into large, empty, colorless cells known as bull form cells.
When the bull form cells in the leaves have absorbed water and are turgid, the leaf surface is exposed while when they are flaccid due to water stress, they make the leaves curl inwards to minimize water loss.
The parallel venation in monocots is reflected in the near similar sizes of vascular bundles (except in main veins) as seen in vertical sections of the leaves.



Assessment

MCQs:

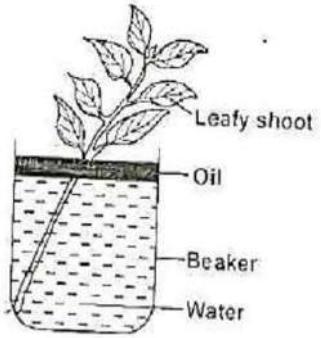
1. Deepak made the following section of a stem. He found the outer layer of tissue a little harder than the inner portion of the stem. The inner portion had dotted appearance.



The peripheral part comparatively harder than the rest of the stem because of the presence of

a) sclerenchymatous hypodermis
b) vascular bundles
c) Parenchymatous hypodermis
d) Collenchymatous hypodermis

1. Most of the water lost by plants during transpiration is through stomata.You are performing an experiment on stomatal transpiration using dorsiventral leaf. You prepare three similar experimentalset up A, B and C as shown in the diagram below and put them in the sun for 2 hr.



Set A No Vaseline applied. Set B Vaseline applied on lower surfaces of leaves. Set C Vaseline applied on the upper surfaces of leaves. In which set up will you find maximum and minimum lowering of water level?

a. Set A – Maximum & Set B- Minimum
b. Set B – Minimum & Set B - Maximum
c. Set A and Set B have equal lowering
d. No lowering of water level observed

3. Palisade and spongy parenchyma are found in-
(a) stem (b) root (c) leaf (d) flower

4. Bulliform cells are the characteristic features of
a) Isobilateral leaf (b) Monocot root (c) Dorsiventral leaf (d) Dicot root

Hint: 1a, 2a, 3c, 4a

Assertion/Reason type Questions:

(a) If both Assertion (A) and Reason (R) are true and Reason is the correct explanation of assertion.
(b) If both Assertion (A) and Reason (R) are true, but reason is not the correct explanation of assertion.
(c) If Assertion (A) is true, reason (R) is false.
(d) If both assertion (A) and reason (R) are false

1. Assertion: open vascular bundle shows cambium.
Reason: plants having such vascular bundle possess the ability to form secondary xylem and phloem tissues.

2.Assertion: Plants having closed vascular bundle possess the ability to form secondary xylem and phloem tissues.
Reason: Dicot plants have such vascular bundles
Hint: 1a, 2d

Short answer type:

1. You are given a cut transverse section of young stem of a plant from your school garden to observe it under the microscope. How would you ascertain whether it is a monocot stem or a dicot stem? Give 3 reasons.
2. What is stomatal apparatus? Explain the structure of stomata with a labelled diagram.
3. Where are bulliform cells found?
4. Which chemical sunstance is found in Casparian strips present in dicot roots?

Long answer type:

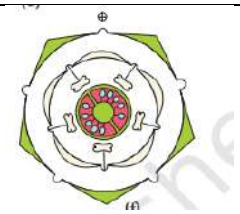
1. The transverse section of a plant material shows the following anatomical features –
(a) The vascular bundles are conjoint, scattered and surrounded by a sclerenchymatous bundle sheaths. (b) Phloem parenchyma is absent. What and how will you identify it as? Draw diagram also.
2.How is a pinnately compound leaf different from a palmately compound leaf?

Assertion: The arrangement of ovules within the ovary is knownas placentation.
Reason: The placentation is of different types namely,valvate, twisted, imbricate, and vexillary.
a. Both assertion and reason are true, and reason is the correct explanation of assertion.
b. Both assertion and reason are true, but reason is not the correct explanation of assertion.
c. Assertion is true but reason is false.
d. Both assertion and reason are false.

What are bulliform cells and where are these found?
Describe the arrangement of floral members in relation to their insertion onthalamus.
What is stomatal apparatus? Explain the structure of stomata with a labelled diagram.

Read the following and answer any four questions from 16(i) to 16(v) givenbelow:

A student was asked to observe following diagram displayed on a chart in Biology laboratory and draw conclusion based on choices given below. Mark your own opinion in any of the 4 choices-

	The above diagram shows the floral diagram of- a. Potato b. Makoi c. Petunia d. all of these
Gynoecium is correctly marked as- a. bicarpellaryobligately placed, syncarpous; ovary superior, bilocular, placenta swollen with many ovules, axile b. ovary superior, mono carpellary, unilocular with many ovules, style single c. tricarpellary, syncarpous, ovary superior, trilocular with many ovules; axile placentation d. bicarpellary, syncarpous, ovary superior, trilocular with many ovules; axile placentation Flower is- a. bisexual, actinomorphic b. bisexual, zygomorphic c. unisexual, zygomorphic d. unisexual, actinomorphic	The correct floral formula can be written as - a. ⊕ K2+2 C4 A2+4 G(2) b. % K(5) C1+2+(2) A(9)+1 G1 c. Br ⊕P(3+3) A3+3 G(3) d. None of the above Androecium shows- a. stamen six, 3+3, epitepalous b. stamens 10, diadelphous c. stamens 10, epitepalous d. stamens 5, epitepalous

CHAPTER:7STRUCTURAL ORGANIZATION IN ANIMALS

Frog *(Ranatigrina)*

Frogs arecold-blooded organism having abilitytochange colourstohide from enemies.Body isdivisibleintoheadandtrunk,bulgedeyescoveredbynictitatingmembrane. Malefrogis differentfromfemale havingvocal sacsandcopulatorypadonfirstdigitofforelimb.

Digestive System of Frog

- an alimentary canal (digestive tract) and
- associated digestive glands.
- Due to their carnivorous diet, frogs have a relatively short alimentary canal, compared to herbivores.

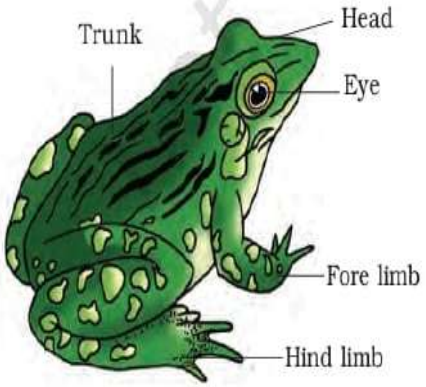


Figure 7.1 External features of frog

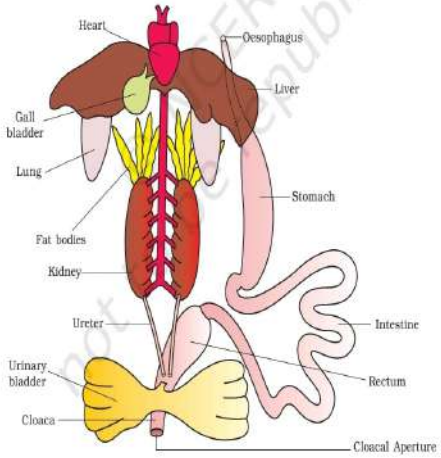


Figure 7.2 Diagrammatic representation of internal organs of frog showing complete digestive system

1. Alimentary Canal:

Mouth:The digestive process begins in the mouth, where food is taken in. Frogs have a sticky tongue to capture prey.

Buccal Cavity:The food then moves into the buccal cavity, a space between the gums and inside of the cheeks.

Pharynx:The pharynx is a region at the back of the mouth, connecting to the esophagus.

Oesophagus:A short, narrow tube that transports the food to the stomach.

Stomach:The stomach is a sac-like organ where food is further broken down, with two distinct regions: the cardiac and pyloric stomach.

Small Intestine:The small intestine is divided into the duodenum (where most digestion occurs) and the ileum (where nutrients are absorbed).

Large Intestine:The large intestine leads to the cloaca.

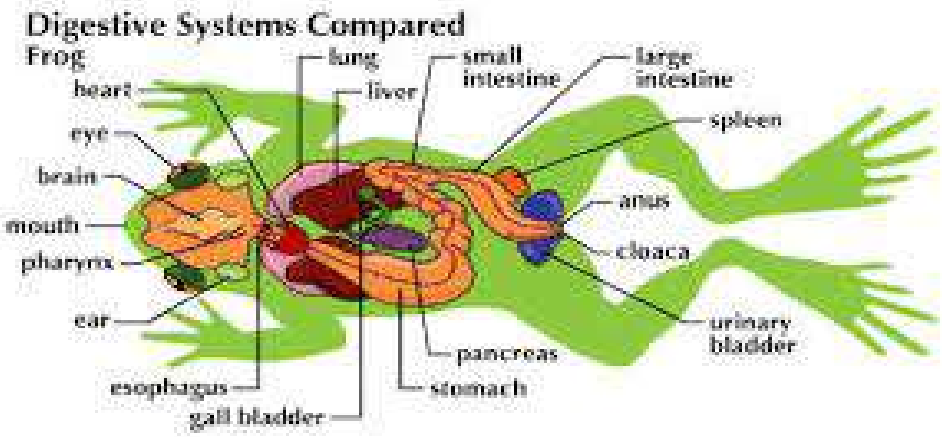
Cloaca:A common chamber where waste products (solid and liquid) and reproductive products exit the body.

2. Digestive Glands:

Liver: Produces bile, which aids in fat digestion.

Pancreas: Produces pancreatic juice, which contains digestive enzymes.

Gallbladder: Stores bile produced by the liver.



Reproductive system

The frog's reproductive system is sexually dimorphic, meaning there are distinct male and female systems.

The male frog's system includes testes, vasa efferentia, and a cloaca, while the female's system has ovaries, oviducts, and a cloaca.

Fertilization in most frog species is external, occurring in water after the male and female release their gametes.

Urinogenital system

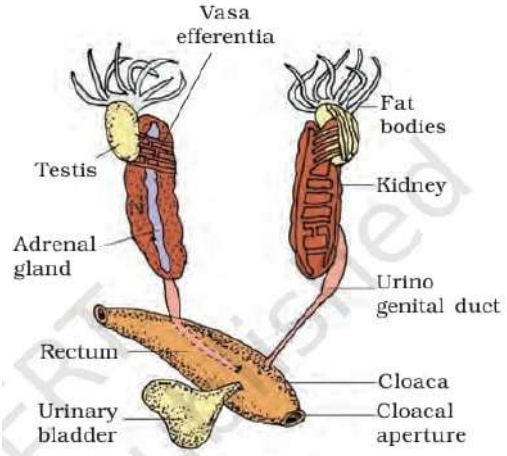


Figure 7.3 Male reproductive system

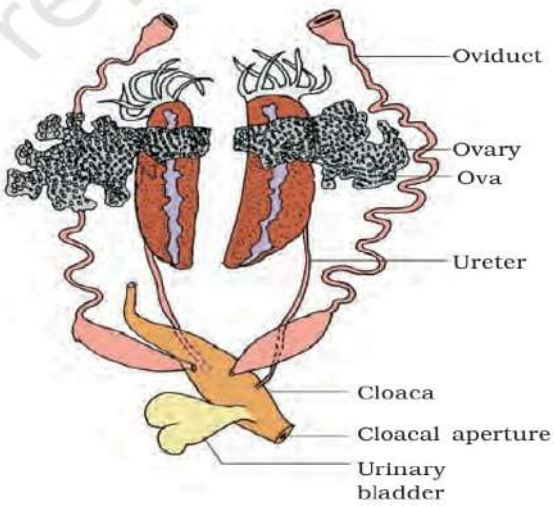


Figure 7.4 Female reproductive system

Male Reproductive System:

Testes: A pair of oval, yellowish testes located near the kidneys, attached by a double fold of peritoneum called the mesoorchium.

Vasa Efferentia: A series of 8-12 small ducts that carry sperm from the testes.

Urinary Duct (Ureter): Connects the kidneys to the cloaca, carrying both urine and sperm.

Cloaca: A common chamber that serves as an exit point for both reproductive and excretory materials.

Reproductive Process:

Amplexus: The male frog clasps the female, ensuring that the sperm meets the eggs.

Gamete Release: The female releases eggs, and the male releases sperm into the water.

External Fertilization: Sperm fertilizes the eggs in the water.

Development: The fertilized eggs develop into tadpoles, which then undergo metamorphosis to become adult frogs.

Female Reproductive System:

Ovaries: A pair of ovaries, attached to the kidneys and dorsal body wall by folds of peritoneum called mesovarium.

Oviducts: A pair of coiled tubes that carry eggs from the ovaries to the cloaca.
Ovisacs: Dilated portions of the oviducts that store eggs temporarily before release.
Cloaca: The same cloaca as in the male, serving as the exit point for eggs

Respiration:

Frogs respire on land and in the water by two different methods.
In water, skin acts as aquatic respiratory organ (cutaneous respiration).
Dissolved oxygen in the water is exchanged through the skin by diffusion.
On land, the buccal cavity, skin and lungs act as the respiratory organs.
The respiration by lungs is called pulmonary respiration.
The lungs are a pair of elongated, pink coloured sac-like structures present in the upper part of the trunk region (thorax). Air enters through the nostrils into the buccal cavity and then to lungs.
During aestivation and hibernation gaseous exchange takes place through skin.
The vascular system of frog is well-developed closed type.
Frogs have a lymphatic system also. The lymphatic system consists of lymph, lymphchannels and lymph nodes.
The blood vascular system involves heart, blood vessels and blood.
Heart is a muscular structure situated in the upper part of the body cavity. It has three chambers, two atria and one ventricle and is covered by a membrane called pericardium.
A triangular structure called sinus venosus joins the right atrium. It receives blood through the major veins called vena cava. The ventricle opens into a saclike conusarteriosus on the ventral side of the heart.
The blood from the heart is carried to all parts of the body by the arteries (arterial system).The veins collect blood from different parts of body to the heart and form the venous system. Special venous connection between liver and intestineas well as the kidney and lower parts of the body are present in frogs. Theformer is called hepatic portal system and the latter is called renal portalsystem.
The blood is composed of plasma and cells. The blood cells areRBC (red blood cells) or erythrocytes, WBC (white blood cells) or leucocytes and platelets. RBC's are nucleated and contain red coloured pigment namely haemoglobin.
The lymph is different from blood. It lacks fewproteins and RBCs. The blood carries nutrients, gases and water to therespective sites during the circulation. The circulation of blood is achievedby the pumping action of the muscular heart.

Excretory System:

The excretory system consists of a pair ofkidneys, ureters, cloaca and urinary bladder. These are compact, darkred and bean like structures situated a little posteriorly in the body cavityon both sides of vertebral column.
Each kidney is composed of severalstructural and functional units called uriniferous tubules or nephrons.
Two ureters emerge from the kidneys in the male frogs. The ureters act asurinogenital duct which opens into the cloaca.
In females the ureters andoviduct open seperately in the cloaca. The thin-walled urinary bladder ispresent ventral to the rectum which also opens in the cloaca.
The frogexcretes urea and thus is a ureotelic animal.

The system for control and coordination

Itincludes both neural system and endocrine glands.
The prominent endocrineglands are --- pituitary, thyroid,parathyroid, thymus, pineal body, pancreatic islets, adrenals and gonads.
The nervous system------ central nervous system (brain and spinal cord), peripheral nervous system -----(cranial and spinal nerves) and an autonomicnervous system (sympathetic andparasympathetic).
There are ten pairs of cranialnerves arising from the brain. Brain is enclosedin a bony structure called brain box (cranium).

The brain is divided into fore-brain, mid-brainand hind-brain.
Forebrain includes olfactorylobes, paired cerebral hemispheres and unpaireddiencephalon.
The midbrain is characterised bya pair of optic lobes.
Hind-brainconsists ofcerebellum and medulla oblongata. The medullaoblongata passes out through the foramenmagnum and continues into spinal cord, which
is enclosed in the vertebral column.
Sense organs, namelyorgans of touch (sensory papillae), taste (tastebuds), smell (nasal epithelium), vision (eyes) andhearing (tympanum with internal ears).
Eyes in a frog are a pair ofspherical structures situated in the orbit in skull.
These are simple eyes (possessing only one unit).
External ear is absent in frogs and only tympanumcan be seen externally. The ear is an organ ofhearing as well as balancing (equilibrium).

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Questions

MCQs:

1. Male frogs can be distinguished by the presence of
(a) Sound producing vocal sacs (b) A copulatory pad on the first digit of the fore limbs
(c) Both A and B above(d) None of these
2. Yellowish ovoid testes are adhered to the upper part of kidneys by a double fold of peritoneum called
a)Cloaca (b) Mesorchium (c) Bidders canal(d) copulatory pads.
3. Frogs have the ability to change the colour to hide them from their enemies. This is called
(a) camouflage (b) aestivation (c) hibernation (d) metamorphosis
Assertion/Reason type Question:
(a) If both Assertion (A) and Reason (R) are true and Reason is the correct explanation of assertion.
(b) If both Assertion (A) and Reason (R) are true, but reason is not the correct explanation of assertion.
(c) If Assertion (A) is true, reason (R) is false.
(d) If both assertion (A) and reason (R) are false
4. Assertion: Frogs are sexually dimorphic organisms.
Reason: Females have copulatory pads on forelimb.
Hint: 1b, 2b, 3a, 4 c
Short answer Type:
1. Frogs are not seen during peak summer and winter. How do they protect them?
2. How can Male frogs be distinguished from female frogs morphologically?

Long Answer Type:
Explain how Frogs are beneficial for mankind?

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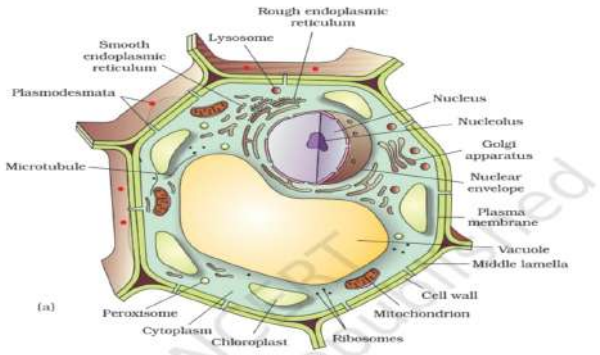
CHAPTER-8 CELL : THE UNIT OF LIFE

CELL THEORY

- **Proposed by: Schleiden (1838) and Schwann (1839)**

- **All living organisms are made of cells.**
- **Cell is the basic unit of life.**
- **All cells arise from pre-existing cells (Virchow's addition).**



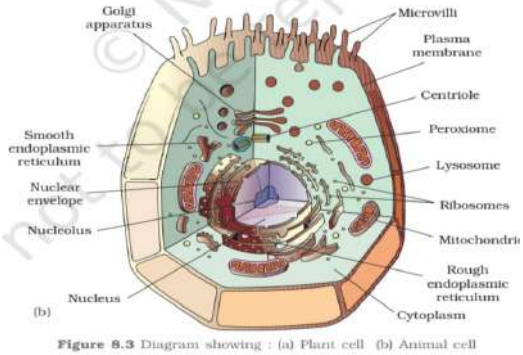


Figure 8.3 Diagram showing : (a) Plant cell (b) Animal cell

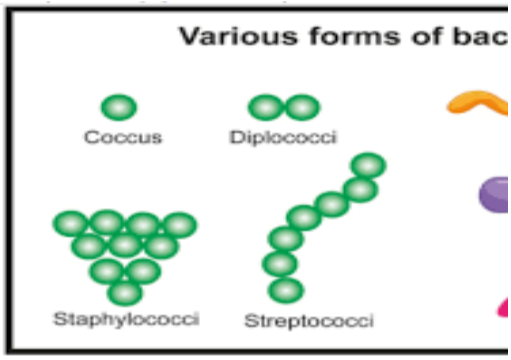
Prokaryotic cell-

1.Definition: Prokaryotic cells are primitive, simple cells without a true nucleus and membrane-bound organelles.

2. Examples: Bacteria, Blue-green algae (cyanobacteria), Mycoplasma, Archaebacteria.

3.Cell wall: Present, peptidoglycan
Cell membrane: Present beneath
Cell wall: Present, peptidoglycan

4.Cell membrane: Present beneath
Nucleoid: Region with a single circular DNA, not enclosed by a membrane.
Ribosomes: (70S type),
Plasmids: present
Nucleoid: Region with a single circular DNA, not enclosed by a membrane.
Ribosomes: (70S type),
Plasmids: present.



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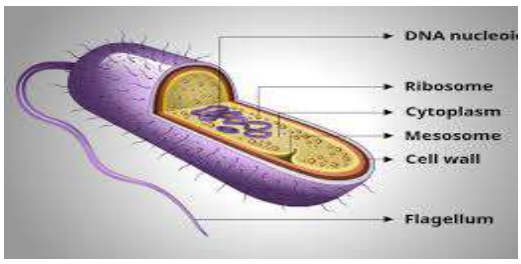
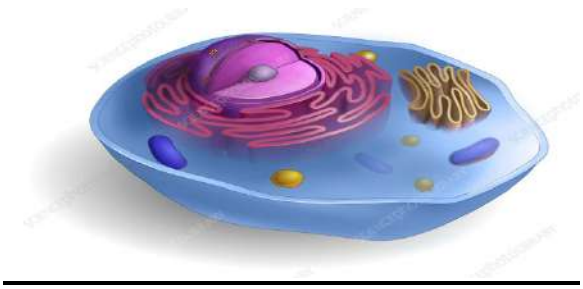


Eukaryotic cell

Nucleus: Well-defined, with a nuclear envelope contains chromatin. (DNA + proteins) and nucleolus.

- Membrane-bound Organelles present: Mitochondria, Golgi Apparatus Lysosomes, Plastids, Vacuoles, Cell Membrane, cytoskeleton.



CELL ORGANELLES-

Cell membrane- The plasma membrane is selectively permeable and facilitates transport of several molecules.

- Cell membrane is mainly composed of lipids and proteins. The major lipids are phospholipids that are arranged in a bilayer.
- Also possess protein and carbohydrate. Model of the cell membrane was proposed by Singer and Nicolson (1972) as fluid mosaic Model.

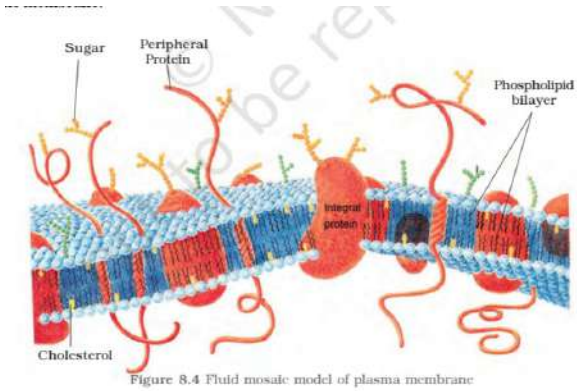


Figure 8.4 Fluid mosaic model of plasma membrane

Cell wall-non-living rigid structure

- An outer covering for the plasma membrane of fungi and plants.

Function- gives shape to the cell and protects the cell, helps in cell-to-cell interaction and provides barrier to undesirable macromolecules

ER-a network or reticulum of tiny tubular structures scattered in the cytoplasm.
1.**Rough ER**- ribosomes attached to their outer surface. Function-involved in protein synthesis and secretion.
2. Smooth ER-absence of ribosomes they appear smooth. Function- site for synthesis of lipid. In animal cells lipid-like steroidal hormones are synthesised in SER.

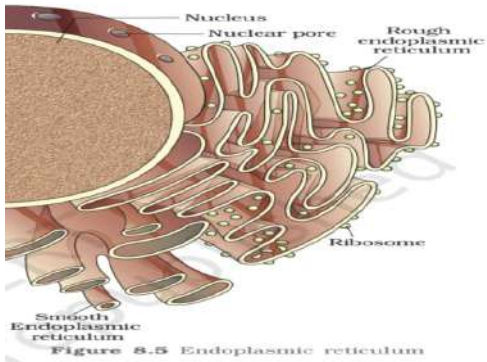


Figure 8.5 Endoplasmic reticulum

Golgi complex- Densely stained reticular structures near the nucleus; consist of many flat, disc-shaped sacs or cisternae. They have cis and trans form.
Function- packaging materials

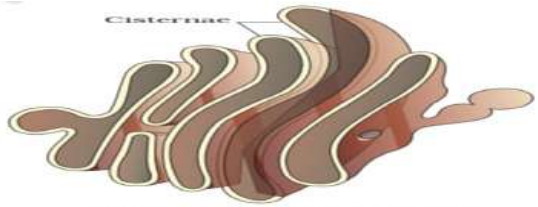


Figure 8.6 Golgi apparatus

Lysosomes- Membrane bound vesicular structures formed by the process of packaging in the Golgi apparatus.
Vacuoles- membrane-bound space found in the cytoplasm.

Function-They have enzymes are capable of digesting carbohydrates, proteins, lipids and nucleic acids
It contains water, sap, excretory product and other materials not useful for the cell.

Mitochondria- specifically stained structure.

- It has inner and outer membrane, and stroma and cristae- number of folding's towards the matrix.
- It is sites of aerobic respiration called power house of the cell and produced ATP.

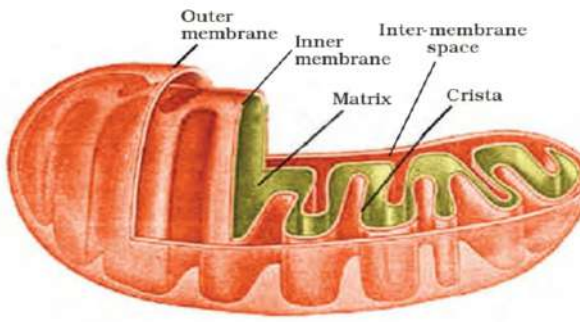


Figure 8.7 Structure of mitochondrion (Longitudinal section)

Plastids- Plastids are found in all plant cells and in euglenoides. They bear some specific pigments, thus imparting specific colours to the plants.ex-

- chloroplast-perform photosynthesis
- leucoplast
- chromoplast.

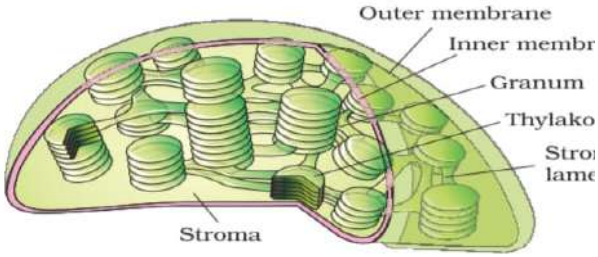


Figure 8.8 Sectional view of chloroplast

Ribosomes-80S type. Observed by dense particles by George Palade (1953). Composed of ribonucleic acid (RNA) and proteins and are not surrounded by any membrane. Each ribosome has two subunits, larger and smaller subunits. The two subunits of 80S ribosomes are 60S and 40S while that of 70S ribosomes are 50S and 30S.

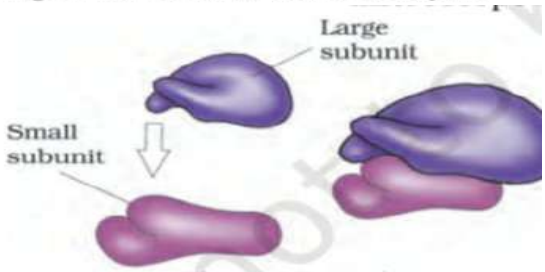
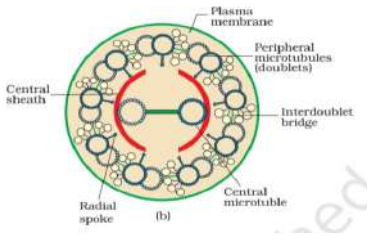


Figure 8.9 Ribosome

Cytoskeleton- An elaborate network of filamentous proteinaceous structures consisting of microtubules, microfilaments and intermediate filaments present in the cytoplasm.

Function- support, motility, maintenance

Cilia and flagella- hair-like outgrowths of the cell membrane.
Cilia- are small structures work like oars, causing the movement.
Flagella-comparatively longer.
Function-cell movement.



Nucleus- double membrane-bound organelle, Discovered by Robert Brown (1831)
Components of Nucleus
1. Nuclear Envelope
2. Nucleoplasm (Nuclear Sap)
3. Chromatin as chromosomes
4. Nucleolus

Function- Stores hereditary information, Directs synthesis of proteins. Controls cell division and growth. Regulates metabolic activities. Formation of ribosomes etc.

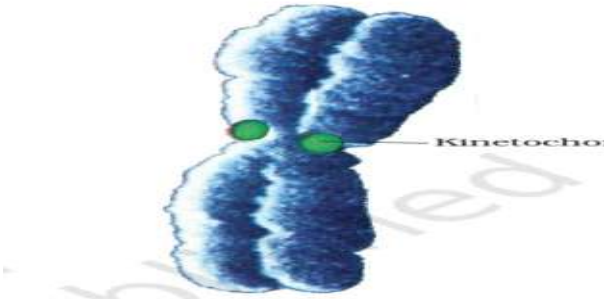


Figure 8.12 Chromosome with kinetochore

MCQ

Q.1 Choose incorrect match-(a) Chloroplast – Thylakoid (b) Golgi bodies – Cristae (c) Mitochondria- stroma (d) Centriole - Microtubules

Q.2 A scientist discovers a new cell that has the following features: A well-defined nucleus, membrane-bound organelles like mitochondria and Golgi apparatus, a cell wall composed of cellulose, large central vacuole. Based on these observations, the scientist concludes that the cell is-a) A prokaryotic bacterial cell b) A eukaryotic animal cell c) A eukaryotic plant cell d) A fungal cell.

Q.3 patient is diagnosed with a genetic disorder that impairs the function of lysosomes. What symptom is most likely to be observed? a) Decreased protein synthesis b) Accumulation of undigested cellular waste c) Increased ATP production d) Inability to carry out photosynthesis

Q.4 Study the diagram below showing an animal cell. Identify the organelle and determine its main function.

A) Mitochondria – Site of protein synthesis
B) Golgi apparatus – Packaging and secretion of proteins
C) Endoplasmic reticulum – Digestion of cellular waste
D) Lysosome – Photosynthesis

Q.5 The function of the cytoskeleton is to:
a. Provide mechanical support to the cell b. store genetic material c. Control protein synthesis d. Regulate the cell cycle

Ans 1 –b, Ans 2-c, Ans 3-b, Ans 4-b , Ans 5-a

ASSERTION-REASON

Question No. 13 to 16 consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:
a) Both A and R is true and R is the correct explanation of A.
b) Both A and R is true and R is not the correct explanation of A.
c) A is true but R is false. d) A is false but R is true.

Q.1 Assertion: Mitochondria are known as the “Power house” of the cell.
Reason: They produce biologically useful energy for the cell activities.

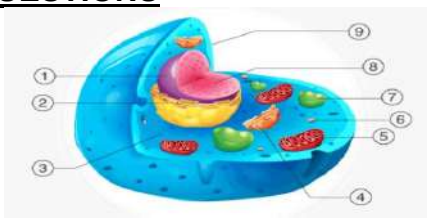
Q.2 Assertion: The Golgi apparatus mainly performs the function of packaging materials.
Reason: Materials to be packed in the form of vesicles from the ER fuse with Trans face of the Golgi apparatus.
Answer – c

Q.3 Assertion: Rudolf Virchow modified the hypothesis of cell theory given by Schleiden and Schwann.
Reason: Cell theory says that all cells arise from pre-existing cells.

Answer 1- a, Answer 2–c, Answer 3-b

2 MARKS QUESTIONS

Q.1 In the above-given cell diagram, numbered 2 is involved in protein transport. Identify the cell organelle.

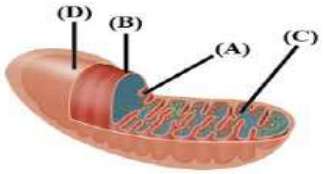


Q.2 A scientist observes a cell under a microscope and finds no nucleus. What type of organism might this be? Justify your answer.
Ans-Prokaryotes because of no nucleus.

Q.3 Mitochondria, chloroplast, and peroxisomes are not part of the endomembrane System. Give Reason.
Ans- The function of some cell organelles is coordinated, these are called endomembrane systems the functions of these are not coordinated with the above components.

3 MARKS QUESTIONS

Q.1.Give an outline of classification of plastids based on pigment and stored nutrients.
Classification – Chloroplast, chloroplast, leucoplast,-amyloplast, elaioplast, leucoplast.



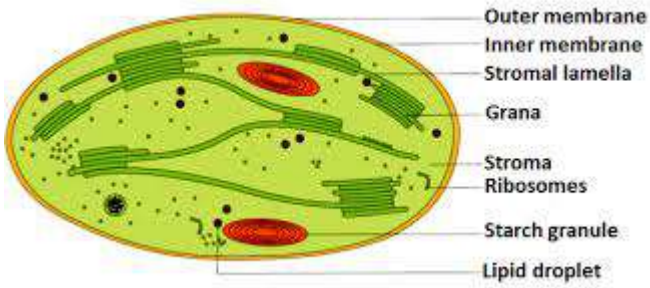
Q.2 Observe the given diagram and answer the questions that follow-
a) Identify the picture shown above.
b) Label A ,B,C and D.

Ans-a) mitochondria) a-matrix, b-inner membrane-cristae-outer membrane

Q.3 Compare the prokaryotic cell and eukaryotic cell on following basis- Nuclear membrane, ribosome, energy production, DNA, cell division Features ,cell division

CASE-BASED QUESTIONS

Q.1 A chloroplast is a type of membrane-bound organelle known as a plastid that conducts Photosynthesis mostly in plant and algal cells. The photosynthetic pigment chlorophyll captures the energy from sunlight, converts it, and stores it in the energy-storage molecules ATP and NADPH while freeing oxygen from water in the cells. The ATP and NADPH are then used to make organic molecules from carbon dioxide in a process known as the Calvin cycle. Chloroplasts carry out a number of other functions, including fatty acid synthesis, much amino acid synthesis, and the immune response in plants. The number of chloroplasts per cell varies from one, in unicellular algae, up to 100 in plants like *Arabidopsis* and wheat.



(a) Name the ground material in Chloroplast. (b) When green tomatoes fruits turn to red, then which pigment is disintegrated and which pigment is formed.
(c) (i) in chloroplasts, the parallel layering of membranes is suited for
(c)(ii)Name the place where Chlorophyll is present in
Chloroplasts?

Q.2 Studies showed that the cell membrane is mainly composed of lipids and proteins. The major lipids are phospholipids that are arranged in a bilayer. Also, the lipids are arranged within the membrane with the polar head towards the outer sides and the hydrophobic tails towards the inner part. This ensures that the nonpolar tail of saturated hydrocarbons is protected from the aqueous environment. In addition to phospholipids, the membrane also contains cholesterol.
(a) Name the major constituent of the cell membrane.
(b) Give the two characters of the tail of cell membrane. Or
(c) Ii.Explain the term active and passive transport.

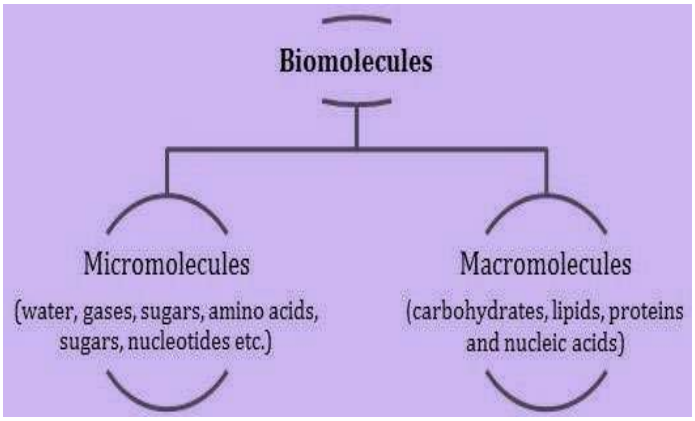
LONG ANSWER TYPE QESTIONS

Q.1 Classify the chromosomes on the basis of the position of the centromere along withdiagram
Q.2 Write the functions of the following- a. Centromere b. Cell wall c. Smooth ER d. Golgi apparatus e. Centrioles.

****

CH-9 :BIOMOLECULES

- Chemicals or molecules present in the living organism are known as biomolecules.
- Biomolecules are divided into two types- inorganic and organic.
- Inorganic biomolecules includes minerals, gases and water and organic biomolecules includes carbohydrates, fats, proteins, nucleic acids, vitamins, etc.
-



ANALYSIS OF CHEMICAL COMPOSITION

- Grind living tissue trichloroacetic acid (Cl3CCOOH). The thick slurry is now strained to filtrate (acid-soluble) and retentate (acid-insoluble). The filtrate contains thousands of organic compounds and some inorganic compounds like sulphate, phosphate.
- The acid insoluble fraction, has only four types of organic compounds i.e., proteins, nucleic acids, polysaccharides and lipids.
- Weighs a small amount of living tissue and burnt it completely. The ash (dry weight) contains inorganic elements

- **1.PROTEINS.** Proteins are polypeptides. They are linear chains of amino acids linked by peptide bonds.

Each protein is a polymer of amino acids. There are about 20 different amino acids exist naturally. Essential; amino acids: dietary amino acid. Non-essential: synthesized inside the body

- Proteins carry out many functions in living organisms, some transport nutrients across cell membranes, some fight infectious organisms, some are hormones, some are enzymes.
-

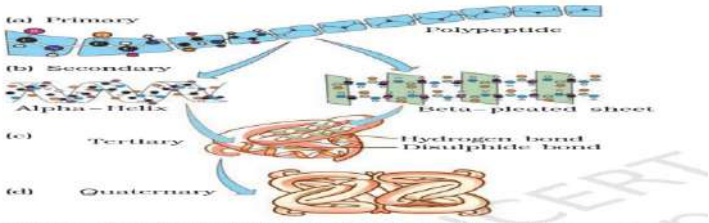


Figure 9.3 Various levels of Protein Structure

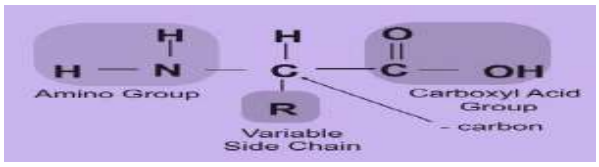
- Collagen -most abundant protein in the animal world.
- Rubisco- most abundant protein in the whole biosphere.

TABLE 9.5 Some Proteins and their Functions

Protein	Functions
Collagen	Intercellular ground substance
Trypsin	Enzyme
Insulin	Hormone
Antibody	Fights infectious agents
Receptor	Sensory reception (smell, taste, hormone, etc.)
GLUT-4	Enables glucose transport into cells

2.AMINO ACIDS

- Each Amino acid consists of Carbon (a-carbon), basic amino group (NH2), carboxylic group(COOH).
- A hydrogen atom (H) and R group. Structurally amino acids differ only in the 'R' group.

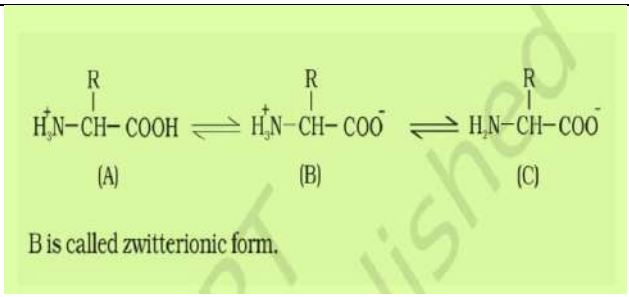


Zwitter ion: At specific pH an amino acid behaves as a zwitterion i.e. contains both positive and negative charge.

Peptide bond

The amino group of one amino acid and the carboxyl group of another amino acid combine together with the loss of water and form a peptide bond.

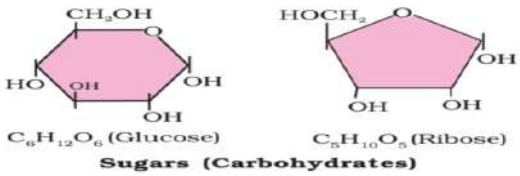
Many amino acids join to form polypeptides (proteins



On the basis of R the amino acids are
Acidic
Basic
Neutral

3.CARBOHYDRATE

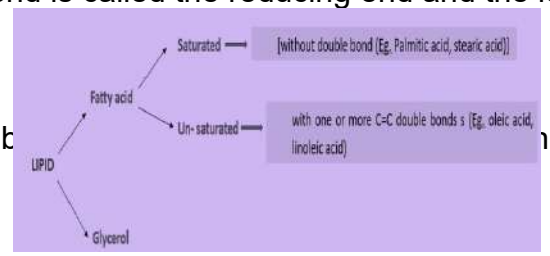
Carbohydrates are polyhydroxy aldoses (e.g. glucose) or ketoses (e.g. fructose).
General formulae is (CH2O)n .They are made up of saccharide monomers.
• Saccharide monomers join together by glycosidic linkage. On the basis of the number of saccharide units, the carbohydrates may be-

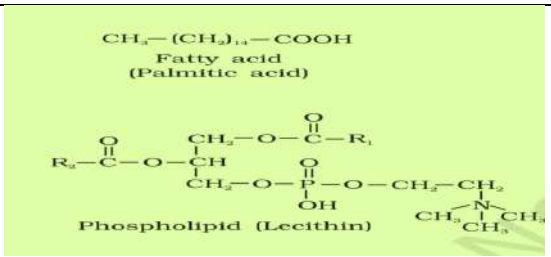


- In a polysaccharide chain (say glycogen), the right end is called the reducing end and the left end is called the non-reducing end.

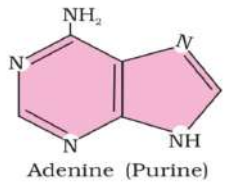
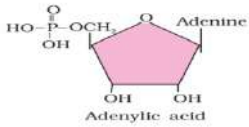
4. LIPID

• Lipids are fatty, waxy, or oily compounds that are solub n polar solvents such as water.



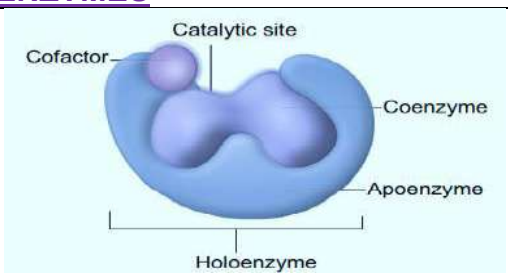
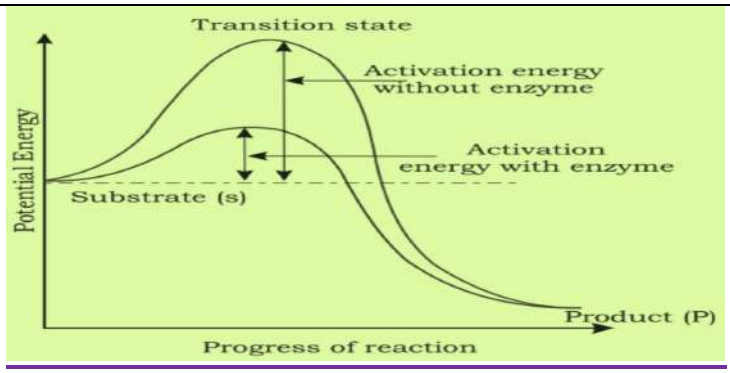
Phospholipids-They have phosphorous and a phosphorylated organic compound. E.g. Lecithin phospholipids, steroids and waxes• They contain long hydrocarbon chains. Example: fatty acids, glycerol, triglycerides,	

Glycerol- It is trihydroxy propane. • Triglycerides: Many lipids have glycerol esterified with acids. These are called as monoglycerides, triglycerides and triglycerides	

5.NUCLEIC ACID In the cell two types of nucleic acids are present - DNA (deoxyribonucleic acid) and RNA (ribonucleic acid) • DNA and RNA function as genetic material. • These are polynucleotide which is made up of nucleotides.	• Nucleotides are joined together by a phosphodiester bond. • Nucleotide is composed of a nitrogen base, a pentose sugar (5-C) and a phosphate	 Adenine (Purine)  Adenylic acid

The nitrogen base is of two types-
Purine: adenine (A) and guanine (G)
Pyrimidine: cytosine (C), thymine (T) and uracil (U)
• Nucleotide: Nucleoside + phosphoric acid group
• Nucleoside: Nitrogenous bas + Pentose

ENZYMES

All enzymes are proteins except ribozymes (nucleic acid). They act as catalysts. They remain unchanged at the end of the reaction. Enzymes are highly substrate specific. Enzymes have active site where substrate binds.	 It get damaged at high tem. i.e. denaturation. Complete enzyme (holoenzyme) has protein part (Apo enzyme as well as non-protein part (cofactor)
Nature of Enzyme Action -First, the substrate binds to the active siteof the enzyme Formation of enzyme-substrate complex	• Formation of enzyme-product complex .The enzyme releases the products of the reaction and the free enzyme is ready to bind to another molecule of the substrate. $E + S \rightleftharpoons ES \longrightarrow EP \longrightarrow E + P$
Concept of activation energy • The minimum amount of energy required by substrates to convert into the product is called an activation of energy. • Enzymes lower the activation energy of the reaction they catalyse.	

Co-factors (non-protein constituent) - prosthetic groups, co-enzymes and metal ions.

• Prosthetic groups: organic compounds, tightly bound to the apoenzyme. For example, in peroxidase and catalase, which catalyze the breakdown of hydrogen peroxide to water and oxygen, haem is the prosthetic group and it is a part of the active site of the enzyme.

• Co-enzymes: organic compounds, loosely bound to the apoenzyme. e.g., coenzyme NAD and NADP contain the vitamin niacin.

• Metal ions: e.g., zinc is a cofactor for the proteolytic enzyme.

Classification and Nomenclature of Enzymes

Oxidoreductase: These enzymes catalyze oxidation and reduction reactions. E.g.- Dehydrogenase

Transferase: These enzymes catalyze the transfer of functional groups such as methyl or phosphate groups. E.g. – Transaminase

Hydrolases: These enzymes catalyze the hydrolysis reactions E.g.- Digestive enzymes

Ligases: These enzymes catalyze the joining of two molecules by making a bond. E.g.- DNA ligase

Isomerases: These class of enzymes brings about the isomerization reaction. E.g.- Isomerase

Lyases: Lyases bring about lysis and cleavage of various bonds. E.g.- Decarboxylase

Factors Affecting Enzyme Activity

Temperature and pH	Concentration of Substrate	Inhibitors
At specific temperature and pH enzyme shows optimum reaction. Low temperature preserves the enzyme in a temporarily inactive state whereas high temperature destroys enzymatic activity because proteins are denatured by heat.	With the increase in substrate concentration, the velocity of the enzymatic reaction rises at first. The reaction ultimately reaches a maximum velocity (Vmax) which is not exceeded by any further rise in the concentration of the substrate	Some chemicals that may inhibit the rate of reactions are called inhibitors. When the inhibitor closely resembles the substrate in its molecular structure and inhibits the activity of the enzyme, it is known as a competitive inhibitor. e.g., inhibition of succinic dehydrogenase by malonate

MCQ

Q.1 Select the option which is not correct with respect to enzyme action:
(a) Substrate binds with enzyme at its active site.
(b) Addition of lot of succinate does not reverse the inhibition of succinic dehydrogenase by malonate.
(c) A non-competitive inhibitor binds the enzyme at a site distinct from that which binds the substrate.
(d) Malonate is a competitive inhibitor of succinic dehydrogenase.
Q.2 Which one is incorrect?
a) Cofactor plays crucial role in catalytic activity of the enzymes
b) Zn is activator of carboxypeptidase
c) Catalase and peroxidase have haem as prosthetic group.d)Coenzymes are inorganic compounds

Q.3 Phosphoglyceride is always made up of:
a) only a saturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached
b) only an unsaturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached
c) a saturated or unsaturated fatty acid esterified to a glycerol molecule to which a phosphate group is also attached
d) a saturated or unsaturated fatty acid esterified to a phosphate group which is also attached to a glycerol molecule
Answer: 1(b),2(d),3(c)

ASSERTION-REASON

Q.1 Assertion: Nucleic acids play a crucial role in the storage and transmission of genetic information.
Reasoning: DNA and RNA, the two types of nucleic acids, carry genetic instructions for the synthesis of proteins and other essential molecules in living cells.
Q.2Assertion: Proteins exhibit structural and functional diversity in living organisms.
Reasoning: The unique sequence of amino acids in a protein determines its three-dimensional structure and, consequently, its function.
Answer: 1a, 2b

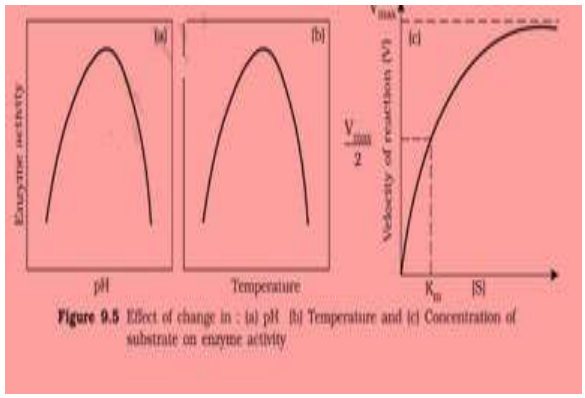
2 MARKS QUESTIONS

Q.1 How unsaturated fatty acids differ from saturated fatty acids. Oils belong to which category.
Q.2 Starch give blue black colour with iodine? Give reason.
Ans: Starch form helical secondary structure which can hold I2.

3 MARKS QUESTIONS

Q.1- (i) Describe the mechanism of enzymatic action.
(ii) What is the activation of energy?
Q.2- (i) In what ratio are purine and pyrimidine present in DNA? (ii) What is the antiparallel nature of DNA? (iii) Who proposed the double helical model of DNA?
(iv) Define the bond which acts as the backbone of the polynucleotide strand.

CASE BASED QUESTIONS

Q.1 Observe the given figure carefully and illustrate- a) the effect of pH on the enzyme activity. b) What changes an enzyme structurally undergo at very high temperature and very low temperature c.i)With the increase in substrate concentration, the velocity of the enzymatic reaction rises at first but once rate of reaction reaches Vmax there is no effect of further increase in substrate concentration. Justify the statement. c.ii)What is Km? Give its importance.	 Figure 9.5 Effect of change in : (a) pH (b) Temperature and (c) Concentration of substrate on enzyme activity

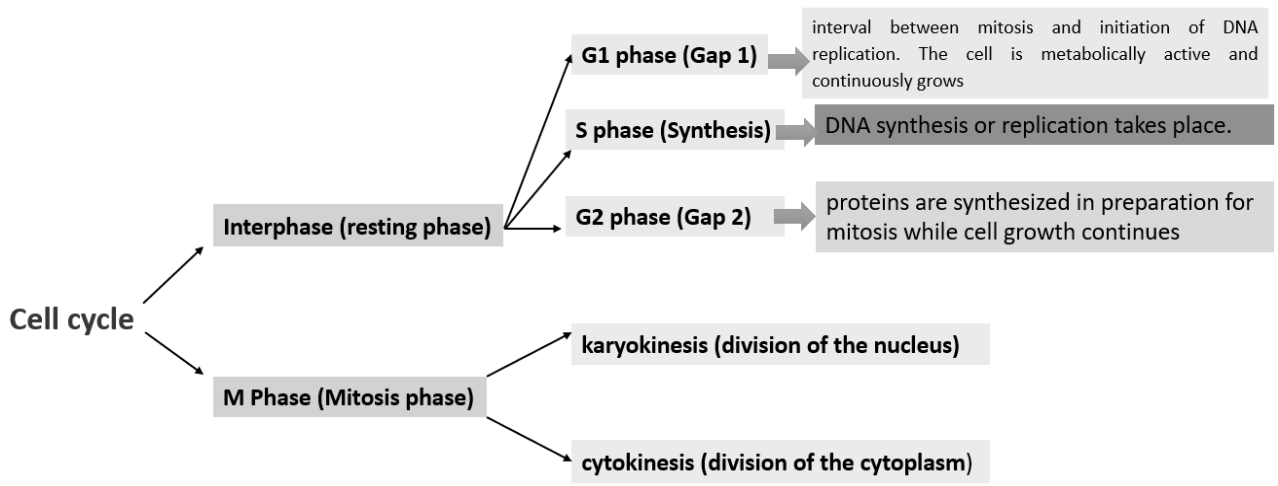
CHAPTER-10: CELL CYCLE AND CELL DIVISION

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 is termed cell cycle.

• Different kinds of cells have varied duration for cell cycle phases.

PHASES OF CELL CYCLE-



G0 Phase: Some cells (like heart cell) exit G1 and enter a quiescent stage called G0, where the cell remains metabolically active without proliferation

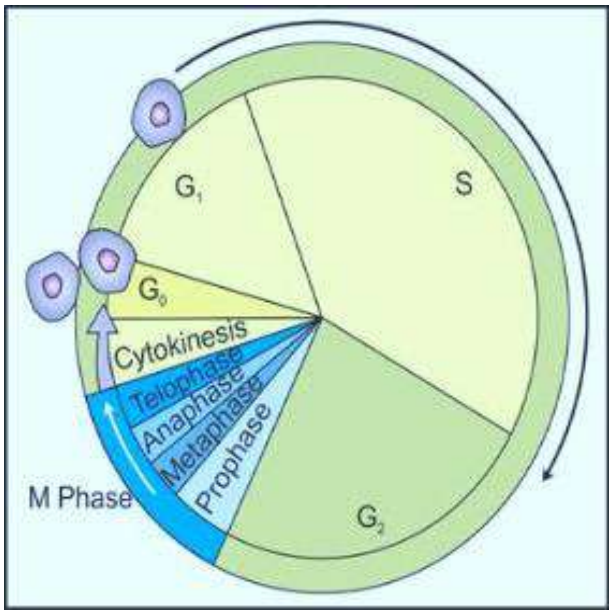
M- Phase

MITOSIS (equational division)

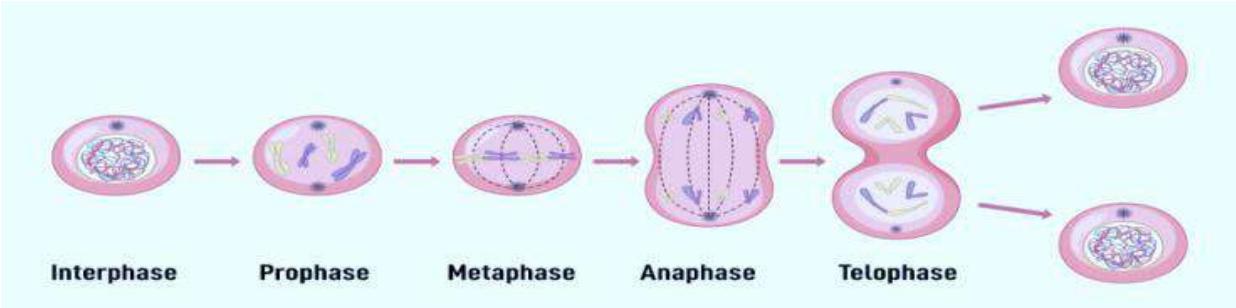
The number of chromosomes in the parent and progeny cells is the same; it is also called equational division.

• Karyokinesis: Prophase, Metaphase, Anaphase, Telophase

• Cytokinesis



- A typical eukaryotic cell cycle is illustrated by human cells in culture. These cells divide once.In approximately every 24 hours. However, this duration of cell cycle can vary from organism to organism and also from cell type to cell type.
- Yeast for example, can progress through the cell cycle in only about 90 minutes.



Significance of Mitosis

• Production of diploid daughter cells with identical genetic complement.

• The growth of multicellular organisms is due to mitosis. Maintain nucleo-cytoplasmic ratio.

• Damaged cells must be replaced by identical new cells by mitosis.

• Helps in regeneration.

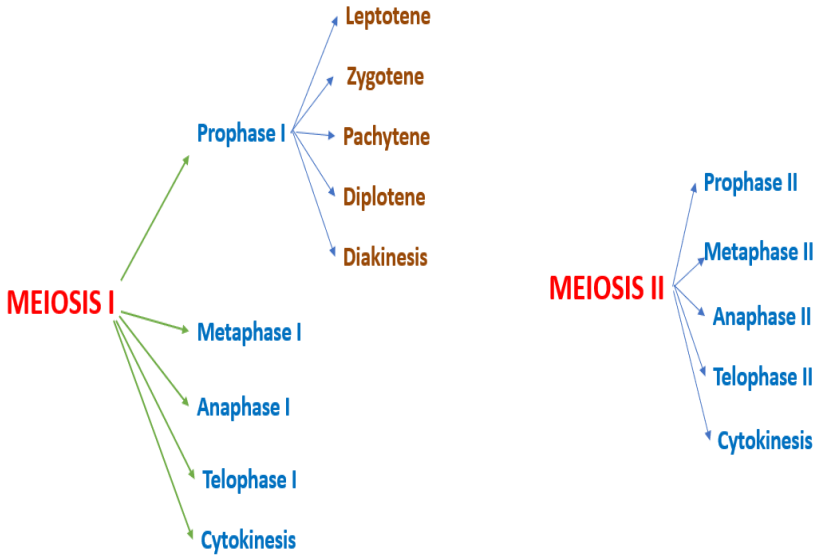
MEIOSIS

Meiosis is a type of cell division in sexually reproducing organisms that reduces the number of chromosomes in gametes.

The key features of meiosis are as follows:

- Meiosis involves two sequential cycles of nuclear and cell division called meiosis I and meiosis II but only a single cycle of DNA replication.
- Meiosis I is initiated after the parental chromosomes have replicated to produce identical sister chromatids at the S phase.
- Meiosis involves the pairing of homologous chromosomes and recombination between non-sister chromatids of homologous chromosomes.
- Four haploid cells are formed at the end of meiosis I

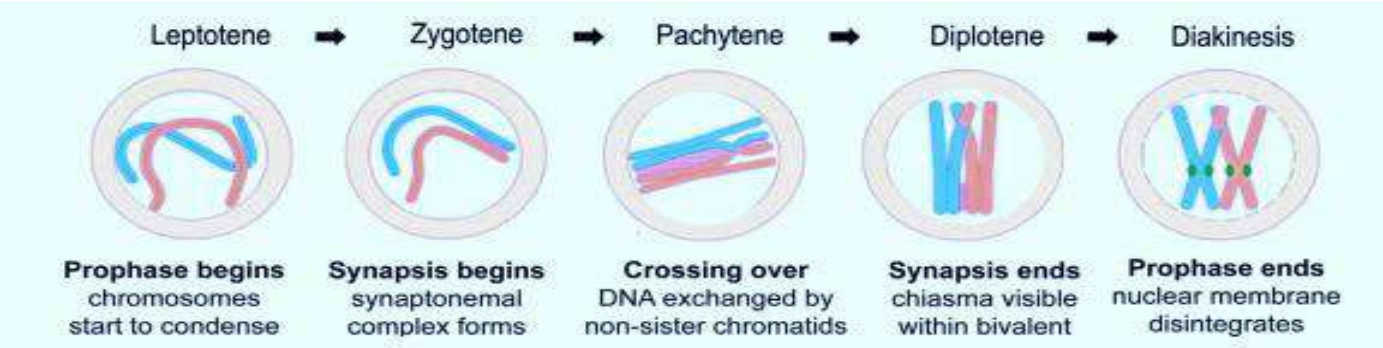
Meiotic events can be grouped under the following phases-



Meiosis I

It is divided in 4 stages-

1. **Prophase I-** Leptotene, Zygotene,Pachytene, Diplotene and Diakinesis



a)Leptotene- The compaction of chromosomes continues throughout leptotene.
b)Zygotene- Chromosomes start pairing (synapsis) in between homologous chromosomes and formation of the synaptonemal complex. The complex formed by a pair of synapsed homologous chromosomes is called a bivalent or a tetrad
c)Pachytene- the appearance of recombination nodules (sites at which crossing over occurs between non-sister chromatids of the homologous chromosomes).

Crossing over leads to the recombination of genetic material on the two chromosomes.
d)Diplotene- Dissolution of the synaptonemal complex. The homologous chromosome of the bivalent separate from each other except at the sites of crossovers (chiasmata
e)Diakinesis- Terminalization of chiasmata. Nucleolus disappears and the nuclear envelope also breaks down

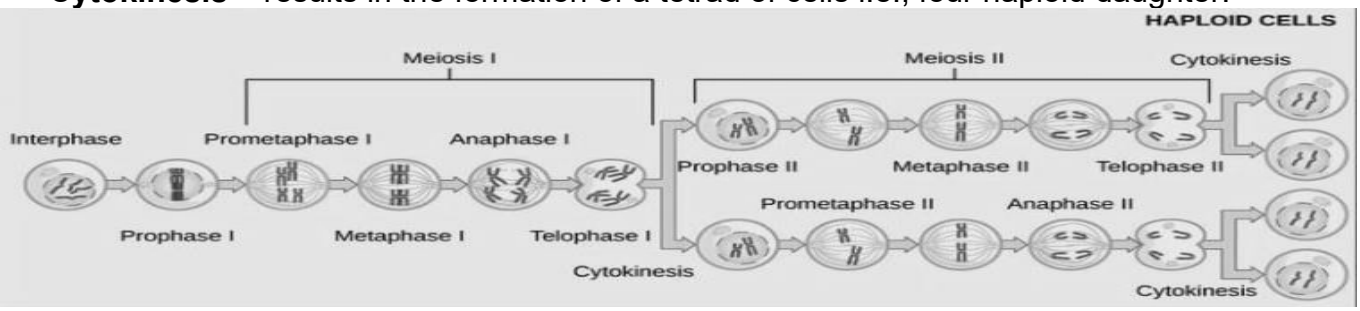
2.Metaphase I: The bivalent chromosomes align on the equatorial plate. The microtubules from the opposite poles of the spindle attach to the kinetochore of homologous chromosomes.
3.Anaphase I: The homologous chromosomes separate, while sister chromatids remain associated at their centromeres.
4.Telophase I: The nuclear membrane and nucleolus reappear, cytokinesis follows and this is called a dyad of cells.

Meiosis II

It is divided in 4 stages-

1. Prophase II: The nuclear membrane disappears by the end of prophase II. The chromosomes again become compact.
2.Metaphase II: chromosomes align at the equator and the microtubules from opposite poles of the spindle get attached to the kinetochores of sister chromatids
3.Anaphase II: splitting of the centromere of each chromosome (which was holding the sister chromatids together), allowing them to move toward opposite poles of the cell by shortening of microtubules attached to kinetochores
4.Telophase II: two groups of chromosomes once again get enclosed by a nuclear envelope

- **Cytokinesis** – results in the formation of a tetrad of cells i.e., four haploid daughter.



Significance of meiosis

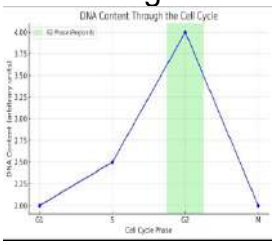
• Conservation of the specific chromosome number of each species.

• It also increases the genetic variability in the population.

MCQ

Q1. A scientist observes a cell under a microscope with distinct chromosomes lined up at the equator of the cell. Which phase is the cell most likely in?
a. Prophase b. Metaphase c. Anaphase d. Telophase
Q2. If a cell is prevented from entering the S phase of the cell cycle, what would be the immediate consequence?
a. The cell would undergo cytokinesis b. The DNA content would double
c. DNA replication would not occur d. The cell would enter mitosis early

Q.3 The graph below shows DNA content through the cell cycle. Which region corresponds to the G2 phase?



a. Region where DNA content doubles b. Region where DNA content remains doubled
c. Region where DNA content halves d. Region where no DNA is present

Q.4Which of the following statements about the cell cycle is incorrect?
a) In M phase, cell grows physically b) In G1 phase; cell grows physically larger and copies organelles
c) In S phase, replication of DNA takes place d) In G2 phase, preparation of mitosis takes place
Ans-1(b), 2(c),3(b),4(a)

ASSERTION-REASON

Question No. 13 to 16 consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:
a) Both A and R is true and R is the correct explanation of A.
b) Both A and R is true and R is not the correct explanation of A.
c) A is true but R is false. d) A is false but R is true.

Q.1 Assertion: Chromosomes are moved to spindle equator and get aligned along metaphase plate through spindle fibres.
Reason: kinetochores serve as the sites of attachment of spindle fibres
Q.2 Assertion: Anaphase is characterised by separation of chromatids
Reason: Splitting of Centromeres results in separation of chromosomes.
Q.3 Assertion: Meiosis is important for gamete formation
Reason: Meiosis is the cell division through which haploid cells can be produced.
Answer: 1(b),2(a),3(a),

2 MARKS QUESTIONS

Q.1 Describe two processes during prophase I of meiosis that lead to genetic variation.
Ans:1. Crossing over between homologous chromosomes exchanges genetic material.
2. Synapsis aligns homologs for recombination, enabling variation in gametes.
Q.2 Why does DNA replication occur during the S phase and not during mitosis in the cell cycle.
Ans: DNA replication occurs during the S phase to ensure that each daughter cell receives an identical set of genetic material. Mitosis is focused on the distribution of already-replicated chromosomes, not on their synthesis.
Q.3 A cell with 20 chromosomes enters meiosis. How many chromosomes and chromatids will each daughter cell have at the end of meiosis ?
Ans: Answer: Each daughter cell will have 10 chromosomes, each consisting of 2 chromatids (i.e., 10 chromosomes, 20 chromatids), as homologous chromosomes are separated in meiosis.
Q.4 Give illustrations to show where four daughter cells from meiosis are equal in size and where they are found unequal in size.
Answer: During the formation of male gametes in human beings (sperms), the four daughter cells formed during meiosis are equal in size. The formation of the female gamete (ovum) during meiosis results in the formation of four daughter cells, unequal in size. The unequal daughter cells are – one big mature ovum and 3 small polar bodies

3 MARKS QUESTIONS

Q.1 In which phase of meiosis are the following formed?

a. Synaptonemal complex, b. Recombination nodules, c. Appearance/activation of enzyme recombinase d.Termination of chiasmata,e. Interkinesis
f. Formation of dyad of cells
Ans. a. Zygotene, b. Pachytene,c. Diakinesis, d. After Telophase-I /before Meiosis-II,
e. Telophase-I,f. After Meiosis-I
Q.2 "Differentiate between mitosis and meiosis based on their significance, chromosome number in daughter cells, and occurrence. Explain how these differences support their respective biological roles."
Q.3 Analyse the events during every stage of the cell cycle and notice how the following two parameters change
(i) The number of chromosomes (N) per cell
(ii) The amount of DNA content (C) per cell

CASE-BASED QUESTIONS

Q.1Anaphase – At the onset of anaphase, each chromosome arranged at the metaphase plate is split simultaneously and the two daughter chromatids, now referred to as daughter chromosomes of the future daughter nuclei, begin their migration towards the two opposite poles. the centromere of each chromosome remains directed towards the pole and hence at the leading edge, with the arms of the chromosome trailing behind.Thus, anaphase stage is characterised Centromeres split and chromatids separate.
Chromatids move to opposite poles.
Telophase –At the beginning of the final stage of karyokinesis, i.e., telophase, the chromosomes that have reached their respective poles de-condense and lose their individuality. The individual chromosomes can no longer be seen and each set of chromatin material tends to collect at each of the two poles. This is the stage which shows the following key events:
Chromosomes cluster at opposite spindle poles and their identity is lost as discrete elements.
Nucleolus, Golgi complex and ER reform.
1) Write the identify feature of Anaphase.
2) In anaphase, chromatids migrates to _____
a) Centromeres b) Opposite poles c) Similar poles d) Both b and c
3) Name the phase in which de-condensation of chromosomes takes place.
4) Enlist the characteristic events that takes place during the telophase.
5) Write the characteristic events that takes place in anaphase?

LONG ANSWER TYPE QUESTION

Q.1 (i) Describe various phases of the cell cycle.
(ii) Give a graphical representation of various phases of the cell cycle.
Q.2 Describe the various stages of meiotic prophase-I? Enumerate the chromosomal events during each stage?

****

CHAPTER: 11 PHOTOSYNTHESIS IN HIGHER PLANTS

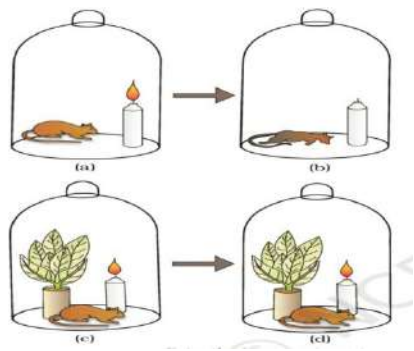
Photosynthesis is a physico-chemical process by which green plants use light energy to drive the synthesis of organic compounds. It is an enzyme regulated **anabolic process.**

$$6CO_2 + 12H_2O \xrightarrow{Light} C_6H_{12}O_6 + 6H_2O + 6O_2$$

Chlorophyll, light andCO2 is required for photosynthesis. It occurs only in green part of leaves and in presence of light.

Early Experiments

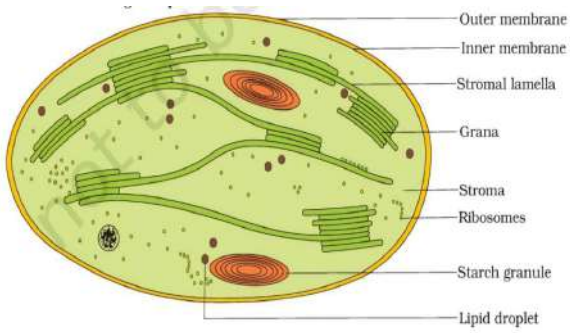
Joseph Priestley in 1770, on the basis of his experiments showed the essential role of air in growth of green plants. Priestley discovered Oxygen gas in 1774.



Priestley's experiments

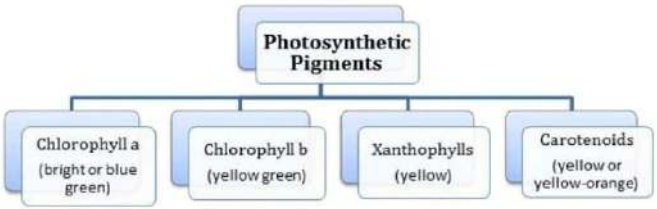
Where Does Photosynthesis Takes Place?

Chloroplasts are **green plastids** which function as the site of photosynthesis in eukaryotic photoautotrophs. Inside the leaves, chloroplast is generally present in mesophyll cells along their walls. Within the chloroplast there is a membranous system consisting of grana, the stroma lamellae and the fluid stroma.



There action in which light energy is absorbed by grana to synthesis ATP and NADPH is called **light reaction.** The later part of photosynthesis in which CO2 is reduced to sugar,light is not necessary and is called **dark reaction.**

Pigments involved in Photosynthesis-



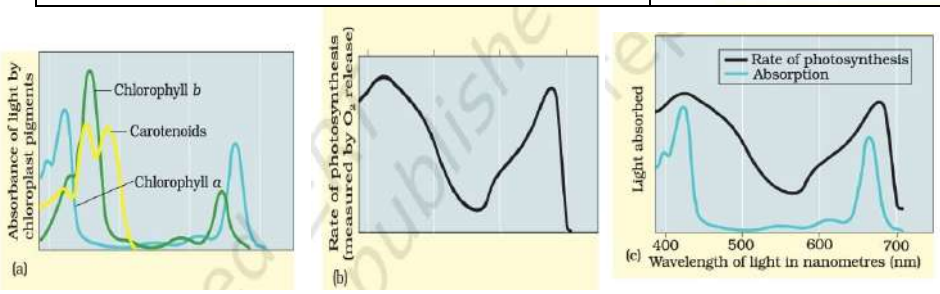


Fig. (a) Graph showing the absorption spectrum of chlorophyll a,b and carotenoids.
(b) Graph showing action spectrum of photosynthesis
(c) Graph showing action spectrum of phototsynthesis superimposed on absorption spectrum of chlorophyll a.

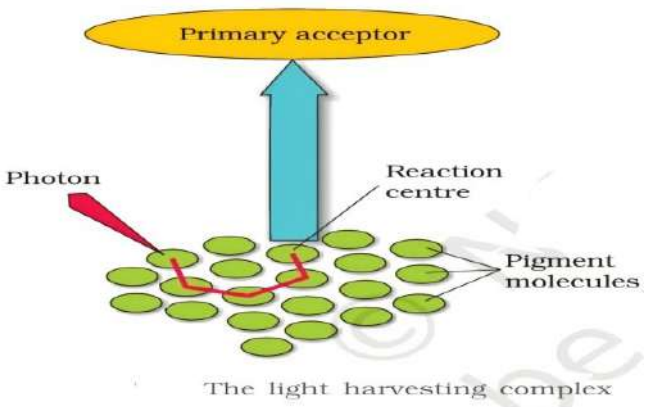
- Maximum absorption by chlorophyll a occurs in blue and red regions having higher rate of photosynthesis. So, **chlorophyll a** is the chief pigment.
- Other thylakoid pigments like chlorophyll b, xanthophylls and carotenoids are called

accessory pigments that absorb light and transfer energy to chlorophyll a and protect them from photo-oxidation.

LIGHT REACTION

Light reaction (photo chemical phase) includes:

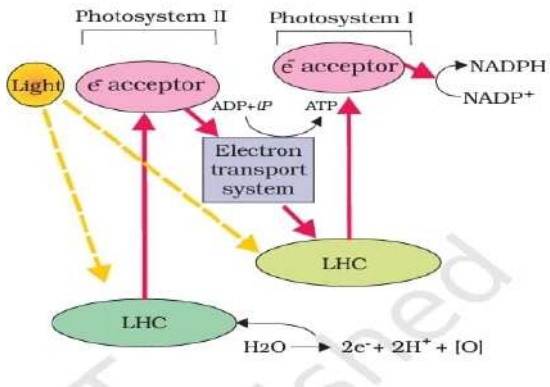
1. Light absorption
2. Water splitting
3. Oxygen release
4. Formation of high energy chemical intermediates (ATP and NADPH).

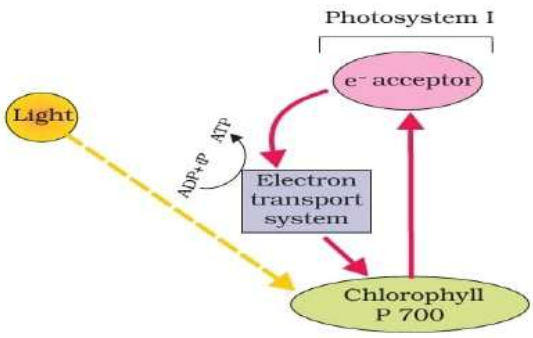
The pigments are organized into two discrete LHC(light harvesting complex) within photosystem I and photosystem II. LHC are made up of hundreds of pigments molecules containing all pigments except single chlorophyll a molecules in each PS. The pigments in photosystem I and photosystem II absorbs the lights of different wavelength. Single chlorophyll a molecule makes the **reaction centre.** In PS I reaction centre has highest peak at 700nm, hence called P700.And PSII reaction centre has highest peak at 680 nm, so called P680	

The Electron Transport System

- Reaction centre of photosystem II absorbs light of 680nm in red region and causing electron to become excited. These electrons are picked by an electron acceptor which passes to electron transport system consisting of **cytochromes.**

Difference between cyclic and non-cyclic photophosphorylation:



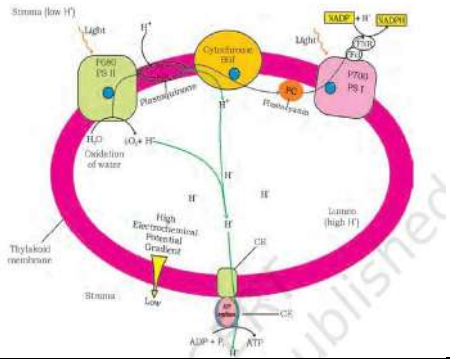


Z-scheme of Light reaction ***Cyclic photophosphorylation***

Cyclic photophosphorylation **Non-cyclic photophosphorylation**

	1. It is performed by collaboration of both PS I and PS II. 2. The process requires an external electron donor. 3. It synthesizes ATP and NADH both. 4. It occurs in the granal thylakoids only.

CHEMIOSMOTIC HYPOTHESIS

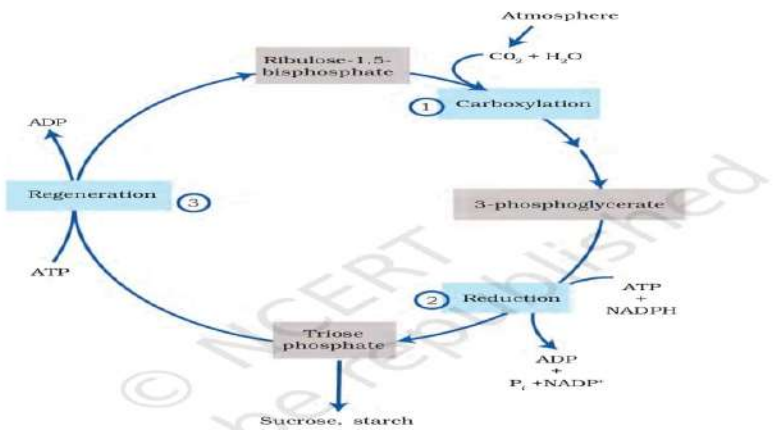
This hypothesis was proposed by Mitchell in 1961.ATP synthesis is linked to development of proton gradient across the membrane of thylakoid and mitochondria.The process that causes development of proton gradient across the membrane is- Splitting of water molecules. As electron passes through the photosystems, protons are transported across the membrane. The **NADP reductase** enzyme is located in the stroma side of membrane. Electrons come out from the acceptor of electron of PSI, protons are necessary for reduction of NADP+ to NADP + H+. This creates proton gradient across the thylakoids membrane along with pH in the lumen.	4. Gradient is broken down due to movement of proton across the membrane to the stroma through trans-membrane channel of **F_O of ATPase.** 5. ATP and NADPH produced due to movement of electron is used immediately to fix CO_2 to form sugar. 

The product of light reaction used to drive the process leading to synthesis of sugar are called **biosynthetic phase** of photosynthesis.

Calvin Cycle /C3cycle/Reductive Pentose Sugar Phosphate Pathway

Malvin Calvin, Benson and their colleagues used radioactive ^{14}C and *Chlorella* and *Scenedesmus* algae to discover that first CO_2fixation product is 3-carbon organic compound (3-phosphoglyceric acid) or PGA. Later on a new compound was discovered which contain 4-carbon compound called Oxaloacetic Acid (OAA).On the basis of number of carbon atoms in first stable product they are named C3 and C4 pathway.
Calvin cycle can be described under three stages:carboxylation,reductionand regeneration.

Carboxylation is the fixation of CO_2into 3-phosphoglyceric acid (3-PGA). Carboxylation of RuBP occurs in presence of enzyme **RuBP carboxylase (RuBisCO)** which results in the formation of two molecules of 3-PGA.
Reduction is series of reaction that leads to formation of glucose.Two molecules of ATP and two molecules of NADPH are required for reduction of one molecule of
$C0_2$. Six turn of this cycle are required for removal of one molecule of Glucose molecules from pathway.
Regeneration is the generation of RuBP molecules for the continuation of cycle.This process require one molecule of ATP.



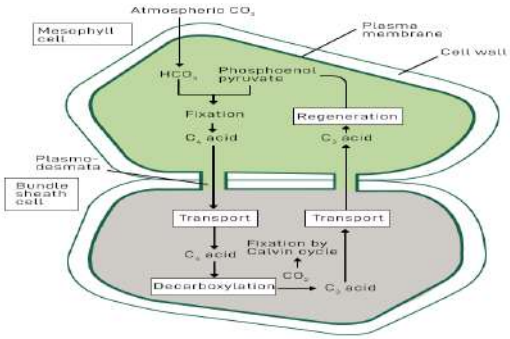
THE CALVIN CYCLE

In	Out
Six CO_2 18 ATP 12 NADPH	One glucose 18 ADP 12 NADP

- For every molecules of CO_2entering the Calvin Cycle ,3 molecules of ATP and 2 molecules of NADPH is required.To make one molecule of glucose 6 turns of cycle is completed so total energy molecule required is

C4 pathway/Hatch Slack Pathway

- This pathway was worked out by Hatch and Slack (1965,1967), mainly operational in plants growing in dry tropical region like Maize, Sugarcane, Sorghum etc.
- In this pathway first stable product is a 4-carbon compound **Oxaloacetic acid**(OAA) so called as C4 pathway.C4 plants have Kranz Anatomy (vascular bundles are surrounded by bundle sheath cells arranged in wreath like manner),characterized by large no of chloroplast, thick wall impervious to gases and absence of intercellular spaces.
- The primary CO_2 acceptor is a 3-carbon molecule **Phosphoenol Pyruvate** present in
- Mesophyll cells and enzyme involved is PEP carboxylase.
- OAA formed in mesophyll cell forms 4-carbon compound like malic acid or aspartic acid which is transported to bundle sheath cells.
- In bundle sheath cell,it is broken into CO_2 and a 3-carbon molecule.The 3-carbon molecule is returned back to mesophyll cells to form PEP.
- The CO_2molecules released in bundle sheath cells enters the Calvin cycle, where
- enzyme RuBisCO is present that forms sugar



HATCH AND SLACK CYCLE

- It is the light dependent process of **oxygenation of RuBP** and release of carbon dioxide by photosynthetic organs of plants.

- Photorespiration decreases the rate of photosynthesis when oxygen concentration is increased from 2-3% to21%.
- Presence of light and higher concentration of Oxygen results in the binding of RuBisC0 enzyme with 0_2 to form.

RuBisC0 + O_2→PGA + phosphoglycolate

This pathway involves **Chloroplast , Peroxisome and Mitochondria.** Photorespiration do not occurs in C4 plants.

C3 plants	C4 plants
1. The leaves donot have Kranz anatomy.	1. The leaves show Kranz anatomy in leaves.
2. Photorespiration occurs.	2. Photorespiration does not occur.
3. RuBisC0 is the first acceptor of CO2.	3. PEP is the first acceptor of CO_2.
4. PGA is the first stable product.	4. OAA is the first stable product.
5. Plants are adapted to all climates.	5. Plants are adapted to tropical climate.
6. Mesophyll cells perform complete photosynthesis	6. Mesophyll cells perform only initial fixation.

Factors affecting photosynthesis

Light-as light intensity increases, the rate of photosynthesis also increases until light saturation point.

Carbon dioxide concentration- with increase in concentration of CO_2 rate of Photosynthesis increase till the compensation point.

Temperature- it does not influence the rate of photosynthesis directly but at higher temperature enzyme activity is inhibited due to denaturation of enzymes which affect the dark reaction.

Water-due to increase in amount of water, rate of photosynthesis does not increase proportionally as after saturation no more water is required during photosynthesis.

Blackman's Law of Limiting Factors states:

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.

ASSESSMENT

Multiple choice questions:

1. Choose the events that occur in non-cyclic photophosphorylation but not in cyclic photophosphorylation.

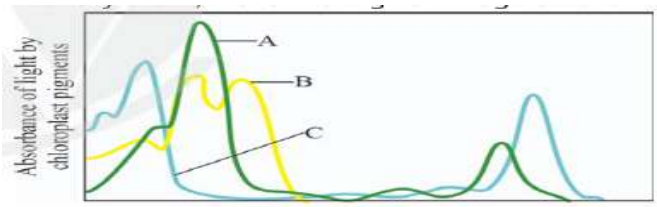
I. Synthesis of ATP **II**. Water splitting **III**.Involvement of PS I **IV**. Formation of NADPH

V. Phosphorylation occurs due to cyclic flow of electrons

Choose the correct answer from the options given below option.

II and IV only (b) I, II and V only (c) II, III, IV and V only (d) II, IV and V only

2.Identify the A, B & C in the given image below:



(a) A-Chl b, B-Carotenoids, C-Chl a (b) A-Carotenoids, B-Chl a, C-Chl b

(c)A-Chl a, B-Carotenoids, C-Chl b (d) A-Chl d, B-Carotenoids, C-Chl a

3. Match List-I with List-II:

List I	**List II**
(A) Calvin cycle	(I) Stroma lamellae
(B) NADP reductase	(II) Stroma side of the thylakoid membrane
(C) Cyclic photophosphorylation	(III) Inner side of thylakoid membrane
(D) Water splitting complex	(IV) Stroma

Choose the correct answer from the options given below:

(a) A-II, B-I, C-III, D-IV (b) A-III, B-I, C-II, D-IV

(c)A-IV, B-II, C-I, D-III (d)A-III, B-II, C-I, D-I

4.What is the role of PEP carboxylase in C4 plants?
(a) It fixes CO_2 into oxaloacetate (b) It generates ATP
(c) It catalyzes the reduction of $NADP^+$ (d) It splits water molecules

5.Which pigment is absent in photosystem I but present in photosystem II?
(a) P700 (b) P680 (c) Chlorophyll b (d) Carotenoids

1.	(a)	2.	(b)	3.	(c)	4.	(a)	5.	(b)

Assertion and Reason type questions :
The following questions consists of two statements, one is Assertion (A) and the other is Reason (R). Select the correct answer to these questions from the codes a,b,c and d as given below.
(a) Both reason and Reason are true but Reason is the correct explanation of Assertion.
(b) Both reason and Reason are true but Reason is the not the correct explanation of Assertion.
(c) Assertion is true but Reason is false.
(d) Both Assertion and Reason are false.

1. Assertion: Chloroplasts mostly occur in mesophyll cells along their walls inside the leaves.
Reason : The membrane system of chloroplast is responsible for trapping the light energy and also for the synthesis of ATP and NADPH.
2. Assertion : 6 molecules of CO_2 and 12 molecules of $NADPH^+ + H^+$ and 18 ATP are used to form one hexose molecule.
Reason : Light reaction results in formation of ATP and $NADPH_2$.
Ans.1-(b) 2-(b)

Two mark questions:

1. Do photosynthetic reactions such as dark reactions require light? Explain.
Ans. Refer to notes
2. **The rate of photosynthesis decreases at higher temperatures. Why?**
3. **In a C3 plant, a light dependent cyclic process is occurring that requires oxygen. Instead of producing, it consumes energy.**
a) Name the processb) Is it necessary for survival?
c) Write the end products of this process.d) Where does it take place?

Ans.

4**. Why do green plants start evolving carbon dioxide instead of oxygen on a hot sunny day?**

Three mark questions:

1.List out the differences in anatomy of leaf in C3 and C4 plants?

Ans. Refer to notes

2. What are the important events and end products of light reaction?

Ans: (a) Bundle sheath **(b)** RuBP **(c)** Oxaloacetic acid **(d)** $20^{o}C$ to $25^{0}C$

4.Distinguish between photosystem – I and Photosystem – II.

Ans:Refer to notes

Case Based Questions:

Light reactions or the 'Photochemical' phase include light absorption, water splitting, oxygen release, and the formation of high-energy chemical intermediates, ATP and NADPH. Several protein complexes are involved in the process. The pigments are organised into two discrete photochemical light harvesting complexes (LHC) within the Photosystem I (PS I) and Photosystem II (PS II). These are named in the sequence of their discovery, and not in the sequence in which they function during the light reaction. The LHC are made up of hundreds of pigment molecules bound to proteins. Each photosystem has all the pigments (except one molecule of chlorophyll a) forming a light harvesting system also called antennae. These pigments help to make photosynthesis more efficient by absorbing different wavelengths of light. The single chlorophyll a molecule forms the reaction centre. The reaction centre is different in both the photosystems. In PS I the reaction centre chlorophyll a has an absorption peak at 700 nm, hence is called P700, while in PS II it has absorption maxima at 680 nm, and is called P680.

1.) Identify the actions, which are not includes in light phase of photosynthesis

(a) Splitting of water molecule(b) Combustion of oxygen

(c)ATP formation(d) Oxygen release

2.) Photosynthesis is _____

(a) Destructive process(b) Energy releasing process

(c) Energy trapping process (d) None of the above

3.) Name the pigment which is referred as reaction centre?

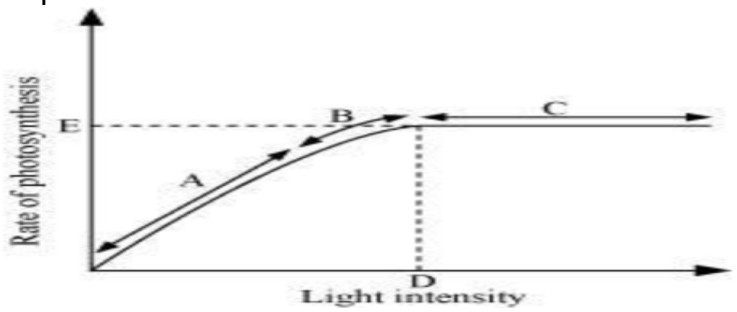
4.) Explain how photosynthetic pigments are arranged?

Answer key

1) b2) c3.) Chlorophyll – a pigment is referred as reaction centre.4.) refer to notes

Long answer questions:

1. 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 regions C and D represent on the curve?

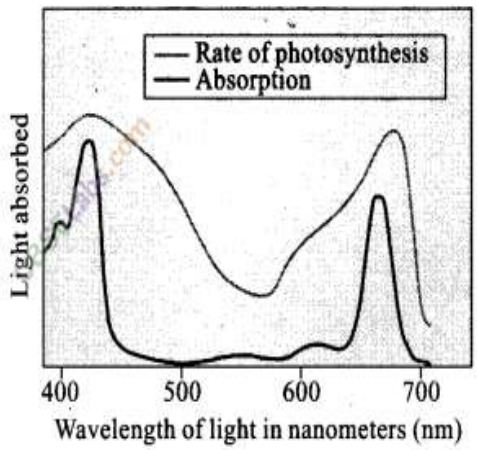


Ans:

(a), Region A with explanation**(b)** In region A.**(c)** Point D with explanation

2.In the figure given below, the light line indicates action spectrum for photosynthesis

and the black line indicates the absorption spectrum of chlorophyll a, answer the following:

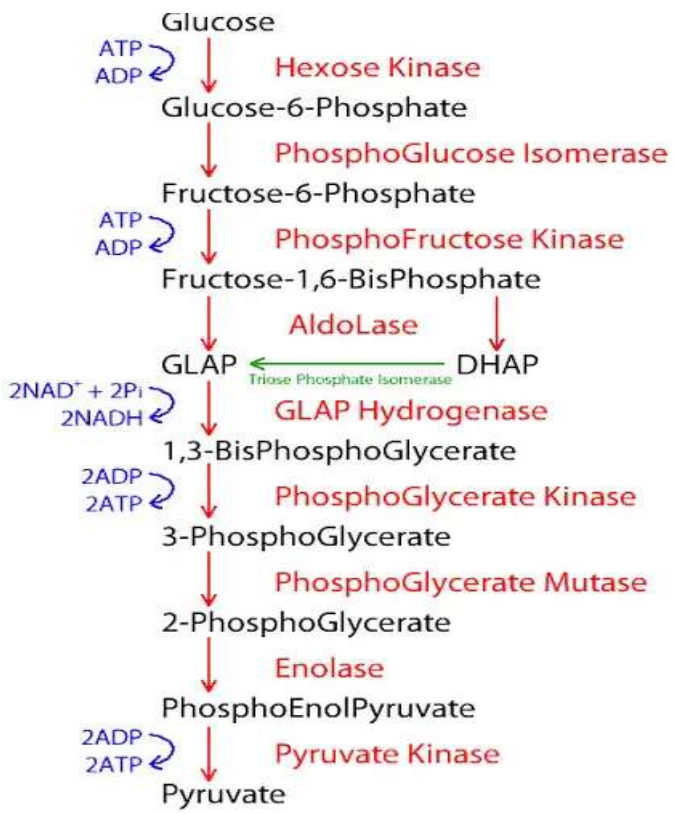


a. What does the action spectrum indicate? How can we plot an action spectrum? Explain with an example.
b. How can we derive an absorption spectrum for any substance?
c. If chlorophyll a is responsible for light **reaction of photosynthesis, why do the action spectrum and absorption spectrum not overlap?**
Ans: Refer to the text above

CHAPTER12: RESPIRATION IN PLANTS

Main Points:

- **Cellular respiration:** the mechanism of breakdown of food materials within the cell to release energy, and the trapping of this energy for synthesis of ATP.
- The breaking of the C-C bonds of complex compounds through oxidation within the cells, leading to release of considerable amount of energy is called respiration.
- **$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ + Energy**
- **Glycolysis:** The breakdown of glucose to pyruvic acid is called glycolysis. It occurs in cytoplasm of cell.It is common to both anaerobic & aerobic respiration .Glycolysis is a ten-step metabolic pathway that breaks down glucose into pyruvate, producing ATP and NADH. Here's a summary of the 10 steps:



1molecule of Glucose forms 02 molecules of Pyruvate.
1 ATP is consumed in step 1
1 ATP is consumed in step 3
2NADH are produced in step 6
2 ATP are produced in step 7
2ATP are produced in step10
In absence of Oxygen-
Total ATP formed = 4 ATP
Total ATP consumed =2ATP
Net Gain = 4ATP-2ATP
=2ATP
In presence of Oxygen-
2NADH = 6ATP
Total ATP Net Gain=6ATP+2ATP
=8ATP

AEROBIC RESPIRATION:(Respiration in presence of Oxygen)

Pyruvate is transported from the cytoplasm into the mitochondria. The crucial events in aerobic respiration are:

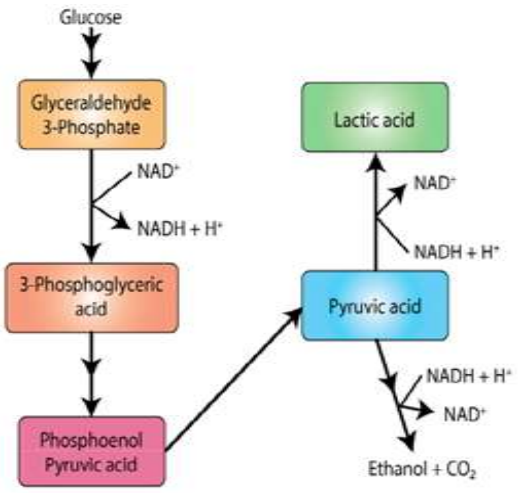
• The complete oxidation of pyruvate by the stepwise removal of allthe hydrogen atoms, leaving three molecules of CO_2.(Kreb's Cycle)

• The passing on of the electrons removed as part of the hydrogenatoms to molecular O_2 with simultaneous synthesis of ATP.(Electron Transport System)

first process takes place in the matrix of the mitochondria while the second process is located on theinner membrane of the mitochondria.

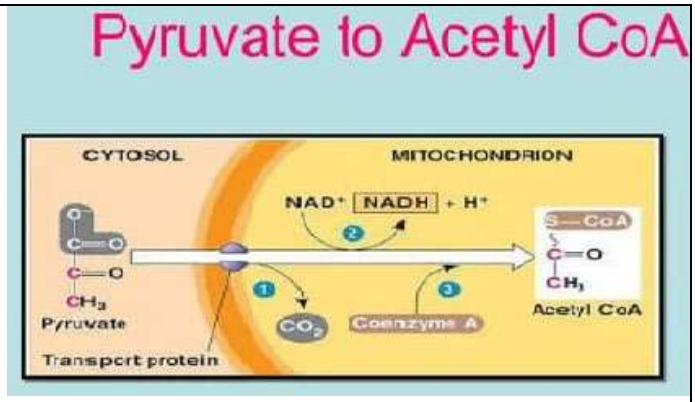
Fermentation

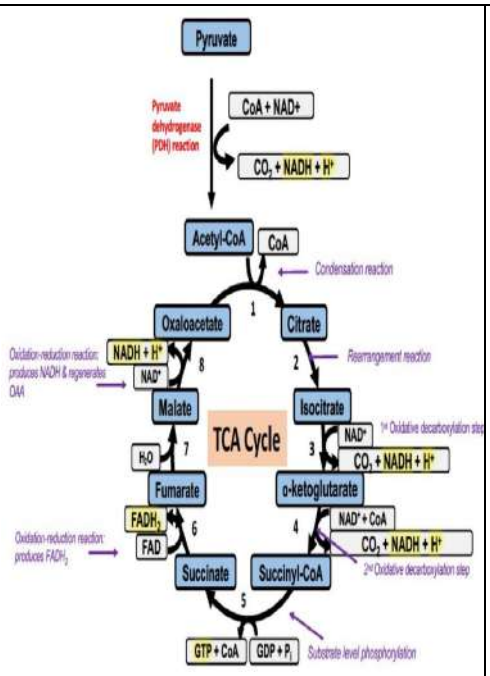
The process in which the incomplete oxidation of glucose is occurs under anaerobic conditions by sets of reactions where pyruvic acid is converted to CO_2 and ethanol. The enzymes, pyruvic acid decarboxylase and alcohol dehydrogenase catalyse these reactions.Some bacteria produce **lactic acid** from pyruvic acid.



In animal cells also, like musclesduring exercise, when oxygen is inadequate for cellular respiration pyruvic acid is reduced to lactic acid by lactate dehydrogenase. The reducing agent is NADH+H+ which is reoxidised to NAD+ in both the processes.In both lactic acid and alcoholic .Fermentation not much energy is released.Energy produced is 2ATP per molecule of glucose.

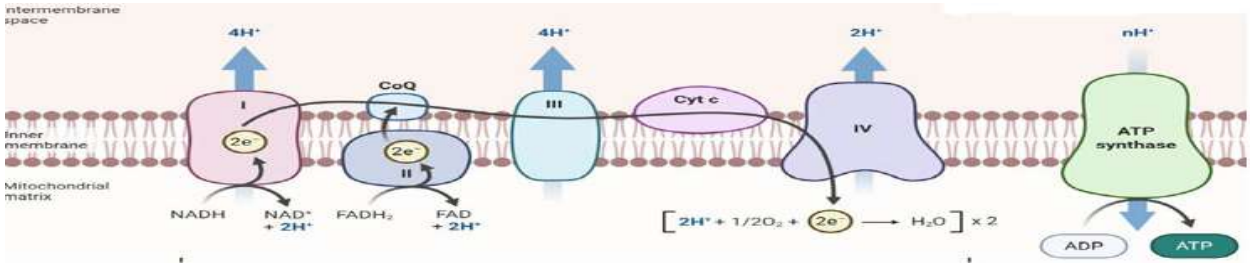
Oxidative decarboxylation: It is linking step between Glycolysis & Krebs' cycle.
*Pyruvate enters in mitochondrial matrix & undergoes **oxidative decarboxylation** by a complex set of reactions catalysed by pyruvic dehydrogenase.
*During this process, two molecules of NADH produced, $2CO_2$ released (Decarboxylation) from the metabolism of two molecules of pyruvic acid & Acetyl Co.A (2 C compound) is formed.





Steps: Kreb's cycle occurs in matrix of Mitochondria.
1-Condensation of Acetyl group of Acetyl Co.A (2C) with Oxaloacetic acid (OAA)(4 C) and water to yield citric acid (6C) in presence of enzyme citrate synthase and a molecule of CoA is released & Citrate (6C) is formed.
2-Citrate is then isomerised to Isocitrate.
3-Two successive steps of decarboxylation occur (CO_2 released) leading to the formation of □-ketoglutaric acid & then Succinyl -Co A. Production of NADH occurs in each successive step respectively.
4-Conversion of succinyl-CoA to succinate occurs & a molecule of GTP is synthesized. From this GTP one ATP is synthesised
5-Conversion of Succinate to Fumerate. Production of $FADH_2$
6- Formation of Malate from Fumerate.
7- Regeneration of Oxaloacetate (OAA) (4C)
Thus –Per Pyruvate Molecule
3 NADH(in Krebs cycle + 1NADH (in Oxidative decarboxylation)= 4NADH equivalent to 12 ATP 1 FADH2 equivalent to 2 ATP
1 GTP equivalent to 1 ATP
are produced. 1 GTP equivalent to 1 ATP
But these ATPs are produced through ETS. (Except from GTP).

Electron Transport System:



ComplexComplex-I	Complex-II	Complex-III	Complex-IV	Complex V
NADH-ubiquinone oxidoreductase complex	succinate dehydrogenase complex	cytochrome bc_1 complex	cytochrome c oxidase complex	F_1F_0 ATP synthase

NADH is **oxidized**by an NADH dehydrogenase (complex I), and electrons are then transferred to ubiquinone located within the inner membrane. Protons H^+ are transferred to inter membrane space.

FADH2is **oxidized by complex II** and electrons are then transferred to ubiquinone located within the inner membrane. Protons H^+ are transferred to inter membrane space.
The reduced ubiquinone (ubiquinol) is then oxidised with the transfer of electrons to cytochrome *c* via cytochrome bc_1complex (complex III).
Cytochrome *c* is a small protein attached to the outer surface of the inner membrane and acts as a mobile carrier for transfer of electrons between complex III and IV.
Complex IV refers to cytochrome *c* oxidase complex containing cytochromes*a* and*a3*,and two copper centres.
ATP synthase (complex V) for the production of ATP from ADP and inorganic phosphate
Oxygen acts as the final hydrogen acceptor along with electron & makes Water.
NADH gives rise to 3 molecules of ATP, while that of one molecule of FADH2 produces 2 molecules of ATP.

AMPHIBOLIC PATHWAY

Earlier Respiration was considered as catabolic process because of breakdown of substrate.
But currently it is considered as amphibolic process. This is because various intermediate compounds of respiration processes are also used in synthesis of compounds .Thus it is anabolic too.

RESPIRATORY QUOTIENT

The ratio of the volume of CO2 evolved to the volume of O2 consumed in respiration is called the respiratory quotient (RQ) or respiratory ratio.

$$RQ = \frac{\text{volume of } CO_2 \text{ evolved}}{\text{volume of } O_2 \text{ consumed}}$$

$$C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + \text{Energy}$$

$$RQ = \frac{6CO_2}{6O_2} = 1.0$$

For carbohydrates the RQ is 1,

$$2(C_{51}H_{98}O_6) + 145O_2 \longrightarrow 102CO_2 + 98H_2O + \text{energy}$$

Tripalmitin

$$RQ = \frac{102CO_2}{145O_2} = 0.7$$

For fat it is less than 1 because they have less Oxygen.

For proteins are respiratory substrates the ratio would be about 0.9.

Multiple Choice Questions 1Marks.

1 How many ATPs are produced in Glycolysis in anaerobic conditions-
(a) 8 ATP (b) 6 ATP (c) 4ATP (d) 2ATP

2 In an experiment the RQ value of a germinating seed was found to be less than 1. What will be possible substrate used in respiration?
(a) Carbohydrate (b) Organic acid (c) Fat (d) None of these

3. Phosphorylation of glucose in Glycolysis is catalysed by-

(a) Hexokinase (b) Phosphoglucomutase (c) Phosphoglucoisomerase (d) Enolase

4 Under aerobic condition Pyruvate undergoes metabolism. Which one is not true in this condition? (a) It forms alcohol & CO_2 (b)It forms Lactic Acid& CO_2 (c)It forms Acetyl Co.A & CO_2 (d)It forms alcohol & Lactic acid

5 Which one is the ultimate H^+ acceptor in aerobic respiration?
(a) Cytochrome (b) Ubiquinone (c) Oxygen (d) FMN

Assertion Reason Questions:

In the following questions a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

(A) Assertion and reason both are correct statements and reason is correct explanation for assertion.

(B) Assertion and reason both are correct statements but reason is not correct explanation for assertion.

(C) Assertion is correct statement but reason is wrong statement.

(D) Assertion is wrong statement but reason is correct statement.

1 Assertion: In Glycolysis substrate level Phosphorylation occurs.
Reason: The 1,3- biphosphoglycerate has phosphate group with high energy bond which takes part in ATP synthesis.

2 Assertion: The compnents of the Electron transport sytem are present in mitochondrial Matrix.Reason: Electron transport system produces ATP by oxidation of NADH & $FADH_2$ inside Mitochondria.

VSA 2 Marks Questions.

1 **Oxygen is an essential requirement for aerobic respiration but it enters the respiratory process at the end? Why?**

2 **Do you know any step in the TCA cycle where there is substrate level phosphorylation? If yes then explain.**

SA 3 Marks Questions.

1 **Why is respiratory pathway referred to as an amphibolic pathway? Explain**

2 **What is Respiratory Quotient (RQ)? Explain why the RQ value of Fat is always lesser than 1?**

3 **Illustrate the glycolysis with the help of flow chart.**

LA marks Questions:

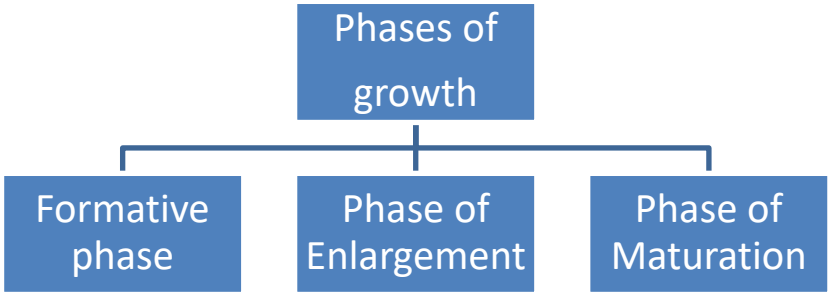
1 **Where does the TCA cycle takes place in cell? What are different steps of the cycle? Explain with line diagram.**

2 **Glycolysis produces NADH & in Kreb's cycle produces NADH & also $FADH_2$ .What happens to them? How ATP are produced by them? Explain**

****

CHAPTER:13 PLANT GROWTH AND DEVELOPMENT

- **Growth** is a permanent or irreversible increase in dry weight,size,mass or volume of cell,organ or organism. It is internalor intrinsic in living beings.
- **Root apical meristem and shoot apical** rneristern are responsible for primary growth and elongation of plant body along the axis.
- **Intercalary meristem** located at nodes produce buds and new branches in plants



- Formativephaseisalsocalledasthephaseofcellformationorcelldivision.Itoccurs at rootapex, shoot apex andother region having meristematic tissue.Therateof respiration isveryhighinthecellsundergoingmitosisdivision informative phase.
- **Phase of Enlargement-** newlyformedcellsproduced informative phaseundergo enlargement. Enlarging cells also develops vacuoles that further increase the volume of cell.
- Cellenlargementoccursinalldirectionwithmaximumelongationinconducting tissues and fibres.
- **Phaseofmaturation-**theenlargedcellsdevelopsintospecialorparticulartypeof cellsbyundergoingstructuraland physiologicaldifference.

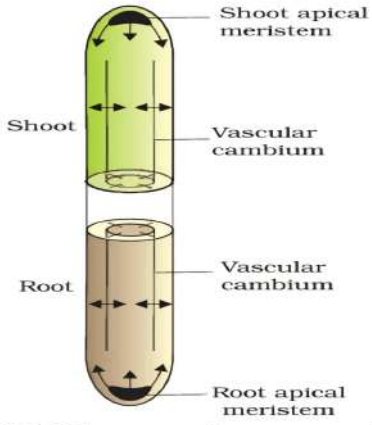


Figure 13.2 Diagrammatic representation of locations of root apical meristem, shoot aplical meristem and vascular cambium. Arrows exhibit the direction of growth of cells and organ

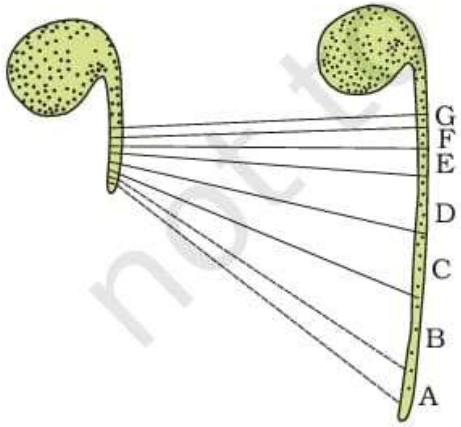


Figure 13.3 Detection of zones of elongation by the parallel line technique. Zones A, B, C, D immediately behind the apex have elongated most.

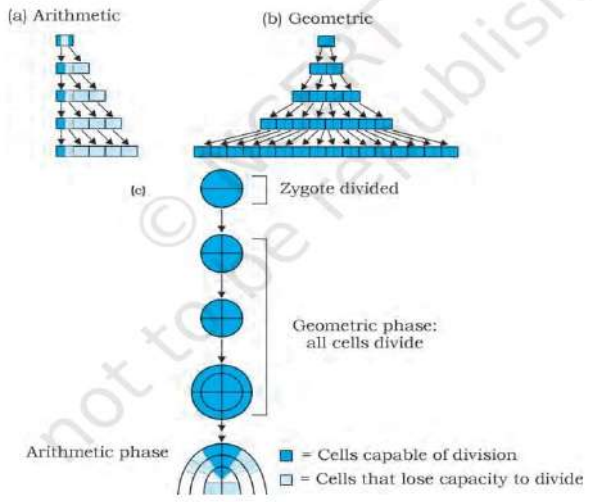
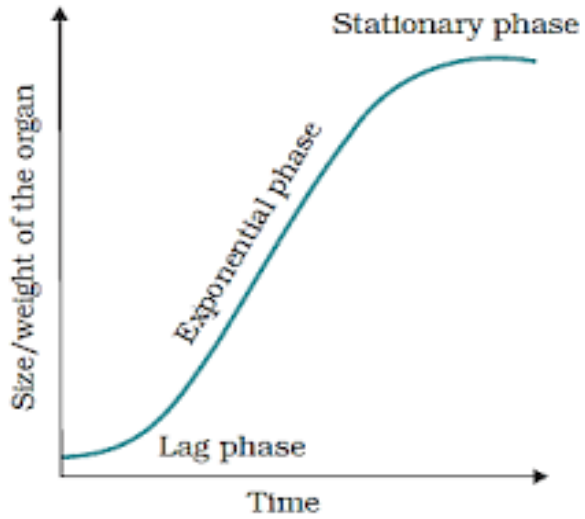


Figure 13.4 Diagrammatic representation of : (a) Arithmetic (b) Geometric growth and (c) Stages during embryo development showing geometric and arithematic phases



An idealized sigmoid growth curve typical of cells in culture and many higher plants and plant organs

Sigmoid growth curve consists of fast dividing exponential phase and stationary phase.Itistypicalof mostlivingorganisms in theirnaturalenvironment.

Plant Growth Regulators are simple molecules of diverse chemical composition which may beindolecompounds, adeninederivativesorderivativesofcarotenoids.

Auxin- wasfirst isolated from human urine. It iscommonly indole-3-aceticacid (IAA). Itis generally produced at stem androotapexandmigratetositeofaction. Functions- 1. Cellenlargement. 2. Apicaldominance 3. Celldivision 4. Inhibitionofabscission 5. InduceParthenocarpy	**Gibberellins-**arepromoter PGRfoundinmorethan100formsnamedasGA_1,GA_2,GA_3....GA_{100}.Themostcommononeis GA_3(GibberellicAcid). Functions- 1. Cellelongation. 2. Breakingofdormancy. 3. Earlymaturity 4. Seedgermination
Cytokinins- theplantgrowthhormoneisbasicinnature.Mostcommonformsinclude kinetin,zeatin,etc.Theyaremainlysynthesizedinroots Functions- 1. Celldivisionandcelldifferentiation. 2. Essentialfortissueculture. 3. Overcomeapicaldominance. 4. Promotenutrientmobilisation	**Ethylene-** itisagaseoushormonewhichstimulates transverseorisodiametricgrowthbut retards the longitudinal one. Functions- 1. Inhibitionoflongitudinalgrowth. 2. Fruitripening 3. Senescence 4. Promoteapicaldominance

1. Multiple Choice questions:

Coconut water contains

(a) ABA(b) auxin(c) cytokinin(d) gibberellin

Ans: (c)

2.Growth can be measured in various ways. Which of these can be used as parameters to measure growth?

(a) Increase in cell number(b) Increase in cell size(c) Increase in length and weight(d) All the above

Ans: (d)

3.To increase sugar production in sugarcanes, they are sprayed with

(a) IAA(b) cytokinin(c) gibberellins (d) ethylene

Ans: (c)

Assertion and Reason type questions : The following questions consists of two statements, one is Assertion (A) and the other is Reason (R).

1.Assertion : Apical dominance is increased by removal of shoot tip.

Reason : Due to accumulation of auxin in lateral parts, growth is inhibited.

2. **Assertion :** Auxins help to prevent fruit and leaf drop at early stages.

Reason : Auxins promote the abscission of older mature leaves and fruits.

Ans- 1 (d) 2 (b)

Two mark questions:

1.While eating watermelons, all of us wish it was seedless. As a plant physiologist can you suggest any method by which this can be achieved.

2.A gardener finds some broad-leaved dicot weeds growing in his lawns. What can be done to get rid of the weeds efficiently?

Three mark question

1. Where are the following hormones synthesised in plants?

a. IAAb. Gibberellinsc. Cytokinins

Ans: a. IAA: Shoot tips and apical bud,b. Gibberellins: Root tips and young leaves, c. Cytokinins: Meristematic zones like root tips

2.Which one of the plant growth regulators would you use if you were asked to:

(a) Induce rooting in a twig.
(b) Quickly ripen a fruit.
(c) Delay leaf senescence.
(d) Induce growth in axillary buds.
(e) 'bolt' a rosette plant.
(f) Induce immediate stomatal closure in leaves.

Case based questions:

Gibberellins are another kind of promontory PGR. There are more than 100 gibberellins reported from widely different organisms such as fungi and higher plants. They are denoted as GA1 , GA2 , GA3 and so on. However, Gibberellic acid (GA3) was one of the first gibberellins to be discovered and remains the most intensively studied form. All GAs are acidic. Their ability to cause an increase in length of axis is used to increase the length of grapes stalks. Gibberellins, cause fruits like apple to elongate and improve its shape. They also delay senescence.

1.) Identify the incorrect function of PGR

a) Cytokinins help to counter apical dominance.

b) Cytokinins were discovered as kinetin.

c) Cytokinins are adenine or purine derivatives

d) Zeatin is the artificial Cytokinin.

2.) _____ is the natural Cytokinin that was extracted and isolated from corn Kernels and Coconut milk.

a) Kinetinb) Zeatinc) Adenined) Purine

3.) Name the first gibberellins discovered ever?

4.) Define bolting.

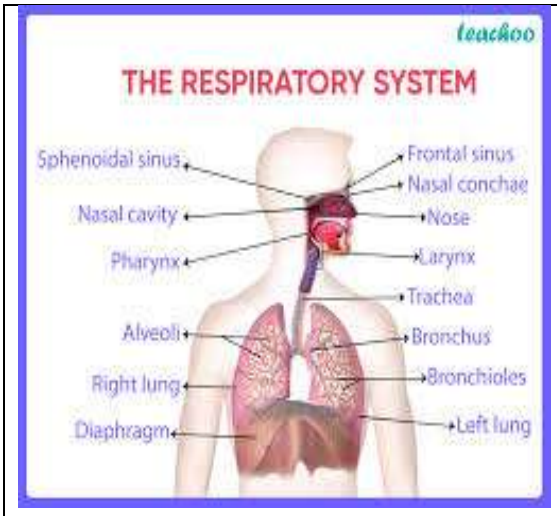
Five mark questions :1. Name a hormone whicha. is gaseous in natureb. is responsible for phototropism. induces femaleness in flowers of cucumberd. is used for killing weeds (dicots)e. induces flowering in long day plants

2.**What would be expected to happen if:**

(a) GA_3 is applied to rice seedlings.(b) dividing cells stop differentiating.

(c) a rotten fruit gets mixed with unripe fruit.

CHAPTER 14:BREATHING AND EXCHANGE OF GASES

	Breathing / Ventilation – First step of respiration, refers to the movements that send fresh air or with dissolved in water to the respiratory organs (inspiration) and removes foul air or water from them (expiration). Respiration – a physio-chemical catabolic process which involves exchange of environmental oxygen with the carbon dioxide produced in the cells during oxidation, at a moist surface to utilize the oxygen for the oxidation of glucose in the mitochondria (power house of cell) to produce the energy, some of which is stored in ATP molecules as biological useful energy.

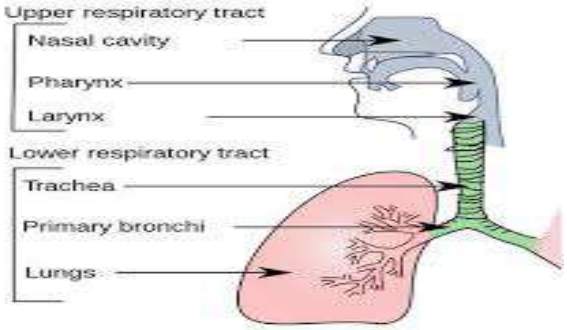
External respiration – intake of oxygen by the blood from water or air in the respiratory organs and elimination of carbon dioxide.	Internal respiration – involves uptake of oxygen by tissue cells via tissue fluid, oxidation of food in tissue cells leading to production of carbon dioxide, water and energy, storage of energy in the form of ATP and release of CO_2 from tissue cells into blood via tissue fluid.
Aerobic respiration involves use of molecular oxygen for breakdown of respiratory substrate and release of carbon dioxide simultaneously.Occurs in most animals and plants.	Anaerobic respiration does not utilize molecular oxygen, for the breakdown of organic substrate and CO_2 may or may not be released.

Cutaneous respiration Exchange of respiratory gases through the thin, moist, permeable and highly vascularised skin.	Buccopharyngeal respiration Exchange of respiratory gases through thin ,vascular lining of buccopharyngeal cavity.
Branchial respiration Exchange of respiratory gases in gills.	Pulmonary respiration Exchange of gases through lungs.

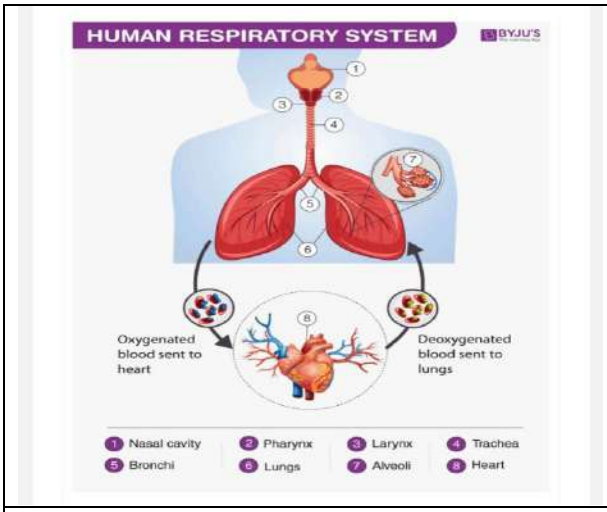
Human Respiratory System

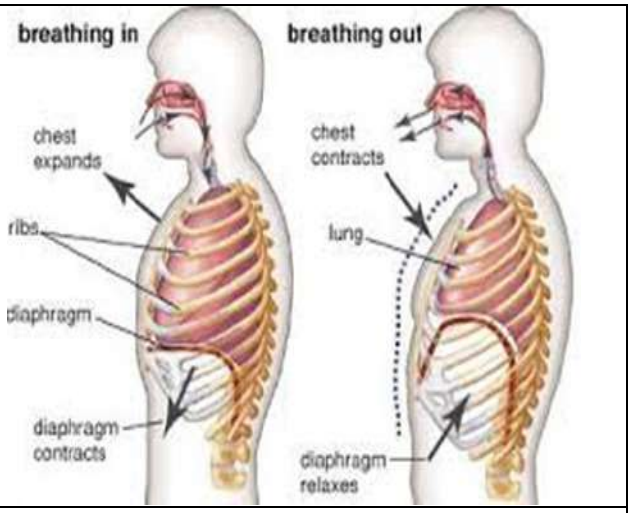
Trachea/ Windpipe: thin walled tube extends downward through the neck. 11cm long and 2.5 cm wide.
Bronchi :Trachea divides into two tubes called bronchi in the middle of the thorax.
Bronchioles :Bronchi divide and re-divide into tertiary bronchi which divide into alveolar ducts which enter into alveolar sacs.
Lungs – Human respiratory chamber Alveolar Sac- In the lung, each alveolar duct opens into a blind, the alveolar sac which appears

like a small bunch of grapes like organs ,located in the thoracic cavity.
Alveoli / Air sacs :The central passage of each alveolar sac gives off several small pouches on all sides, the alveoli or air sacs.



BREATHING MECHANISM –Breathing is brought about by alternate expansion and contraction of the thoracic cavity wherein the lungs lie.





Partial pressure – of a gas is the pressure it exerts in a mixture of gases.

Gaseous exchange – In alveo	– In tissues

due to higher partial pressure of oxygen in oli than in blood, hence oxygen diffuses from oli into the blood through respiratory nbrane.

ygen combines with haemoglobin in red blood s to form oxyhaemoglobin.

rbon dioxide in lung capillaries has higher ial pressure than that in the alveoli, hence it ses from blood into alveoli. • Alveolar air thus omes foul and is renewed.

hen the blood leaves the alveolus, it has almost same partial pressure of O2 and CO2 as the olar air.

• Exchange occurs between blood and tissue cells via tissue fluid. Blood in tissue capillaries has partial pressure of oxygen higher than that in the tissue cells.

• Partial pressure of carbon dioxide is lower than that in the tissue cells.

• Tissue cells constantly use oxygen in oxidation that produces carbon

dioxide, hence, here partial pressure of O2 is lower and partial pressure

of CO2 is higher than the blood coming to them.

• Due to these differences in the partial pressures of CO2 and O2 between blood and tissue cell, O2 separates from oxyhaemoglobin and diffuses from the blood into the tissue fluid and then into the tissue cells and CO2 diffuses from the tissue cells into the tissue fluid and thence into the blood.
• Deoxygenated blood by this respiration returns to the right side of the heart that sends it to lungs for reoxygenation.
Pulmonary air volumes and capacities
Pulmonary / Lung volumes – The quantities of air the lungs can receive, hold or expel under different conditions.
Pulmonary capacity – refers to a combination of two or more pulmonary volumes.
Tidal volume – Volume of air normally inspired or expired in one breath without any effort (500ml for an average adult human male).
Inspiratory reserve volume (IRV) –extra amount of air which can be inhaled forcibly after a normal inspiration (2000-2500 ml).
Expiratory reserve volume (ERV) – the extra amount of air which can be exhaled forcibly after a normal expiration (1000 -1500 ml).
Vital capacity (VC) – Amount of air which one can inhale with maximum effort and also exhale with maximum effort (3.5 – 4.5 litres in normal adult).
TV+ IRV+ ERV = VC
Residual volume (RV) – the air that always remains in the lungs even after forcible expiration. It enables lungs to continue exchange of gases even after maximum exhalation or on holding the breath.
Inspiratory capacity (IC) – Total volume of air which can be inhaled after a normal expiration(IC = TV + IRV = 2500 – 3000 ML).

Functional residual capacity (FRC) – FRC=RV + ERV = 2500 to 3000 ml.

Total lung capacity (TLC) – TLC =VC+ RV (5000 -6000ml). Regulation of respiration

• Respiratory rhythm centre in the medulla of brain - mainly responsible for this regulation.
• Pneumotaxic centre in pons region of the brain moderates functions of respiratory rhythm centre.
• A chemosensitive area, adjacent to rhythm centre is highly sensitive to CO_2 and H^+ ions. Increase in them activates this centre, which in turn signal the rhythm centre to make necessary adjustments in the respiratory process by which these substances can be eliminated.• Receptors associated with aortic arch and carotid artery- also sensitive to CO_2 and H^+ ion concentrations and send signals to rhythm centre for remedial action
Disorders of respiratory System

RESPIRATORY DISORDERS	
Asthma	Difficulty in breathing due to inflammation of bronchi or bronchioles
Emphysema	chronic disorder in which alveolar walls are damaged, like - due to cigarette smoking.
Occupational disorders	disorders In people working in Stone grinding

MULTIPLE CHOICE QUESTIONS

Q1. Which of the following part(s) of respiratory system is affected in asthma -
a) Lungs b) Trachea c) Bronchi and bronchioles d) alveoli
Ans : c) Bronchi and bronchioles

Q2. Excessive cigarette smoking causes which of the following respiratory disorders
a) Emphysema b) Asthma
c) Bronchitis d) All of the above
ANS; d) All of the above

Q3. What is the amount of 02 supplied to tissues through every 100 mL of oxygenated blood
under normal physiological conditions?
a) 5 mL of oxygen/100 mL of oxygenated blood.b) 4 mL of oxygen/100 mL of oxygenated blood.
c) 6 mL of oxygen/100 mL of oxygenated blood. d) It varies from individual to individual.
Ans .a) 5 mL of oxygen/100 mL of oxygenated blood

Q4.What is the amount of C02 supplied to tissues through every 100 mL of deoxygenated blood under normal physiological conditions?
a) 5 mL of carbon dioxide /100 mL of oxygenated blood.b) 4 mL of carbon dioxide /100 mL of oxygenated blood.
c) 6 mL of carbon dioxide /100 mL of oxygenated blood. d) It varies from individual to individual
. Ans.b) 4 mL of carbon dioxide /100 mL of oxygenated blood.

Q5. What will happen if CO_2 level increases in blood?
a. Respiration rate become faster to compensate oxygen requirement.
b.Chemo sensitive area adjacent to respiratory rhythm centre gets activated.
c. Respiratory rhythm centre in medulla gets activated to regulate the breathing rate.
d.All of the above
Ans.d.All of the above

Q6.CO_2 is transported in blood by
a) Dissolving in plasma. b) haemoglobin as Carbamino haemoglobin
c) as bicarbonate ions in RBC and plasma d) All the above
Ans. d) All the above
Q17. Which of the following diseases are occupational respiratory disorder?
(a) Silicosis, Fibrosis and asbestosis (b) Emphysema and mountain sickness
(c) Asthma and Emphysema (d) Asthma and Hepatitis
Ans . (a) Silicosis, Fibrosis and asbestosis

Assertion Reason Based Questions

For questions given below there are two statements marked as Assertion (A) and Reason (R). Choose the correct answer out of following choices.
Codes:
(a) If both Assertion (A) and Reason (R) are true and Reason is the correct explanation of assertion.
(b) If both Assertion (A) and Reason (R) are true, but reason is not the correct explanation of assertion.
(c) If Assertion (A) is true, reason (R) is false.
(d) If both assertion (A) and reason (R) are false
Q1. Assertion - A drop in the blood pH causes an increase in heart rate.
Reason- Increased Heart Rate increases the rate at which CO_2 is delivered to the lungs, where CO_2 is removed.
Q2. Assertion- The maximum pO_2 in alveoli is considerably less than in the atmosphere.
Reason- Lungs in mammals do not completely empty with each breath and inhalation occurs through the same airways as exhalation,so each inhalation mixes fresh air with oxygen depleted residual air.

VERY SHORT ANSWER QUESTIONS

Q1. Arrange the following parts of the human respiratory system in a proper sequence starting from the nose- Nasal cavity, alveolus, trachea, bronchioles, bronchi
Ans: Nasal cavity, trachea, bronchi, bronchioles.
Q2. Write the appropriate volumes of the following respiratory volumes-
Inspiratory Reserve Volume (IRV), Expiratory Reserve Volume (ERV), tidal volume (TV),
Residual Volume (RV)
Ans: IRV (2500 mL to 3000 mL), ERV (1000 mL to 1100 mL), TV (500mL), RV (1100mL to 1200mL)
Q3. Distinguish between Inspiratory Capacity and Expiratory Capacity.
Ans: Inspiratory capacity: It is the volume of air that can be inhaled after a normal expiration.
IC = TV + IRV
Expiratory capacity: It is the volume of air that can be exhaled after a normal inspiration.
EC = TV + ERV
Q4. Distinguish between Vital Capacity and Total Lung Capacity.
Ans: Vital capacity: It is the maximum volume of air that a person can breathe in after forced expiration.

VC=ERV+TV+IRV
Total lung capacity: The total volume of air accommodated in the lungs at the end of a forced Inspiration.
TLC= VC+RV
Q5. What is chloride shift? Explain.
Ans : The diffusion of chloride ions from blood plasma into RBS's is known as chloride shift.
a) Occurs from plasma to RBC's in human body.
b) It maintains ionic balance and electrochemical neutrality.

SHORT ANSWER QUESTIONS

Q1.-A. Explain the oxygen dissociation curve. Briefly explain how H+ ion and CO2 concentration affects the binding of oxygen to haemoglobin in lungs and in tissues.

B. Diagrammatically represent the exchange of gases (O2 and CO2) at the alveolus and the body tissues with blood.

Ans:-B. REFER TO NCERT

Q2. What is the role of the carbonic anhydrase enzyme in the transport of gases during respiration?

Case Study based Question

Q1. A yogi does pranayama every day. His strength of breathing increases. Deep breaths fill the lungs with oxygen which makes him feel young and energetic.
a) How can we increase the strength of inspiration and expiration?
b) How many times does a healthy human adult breathe in one minute?
c) Name the instrument which is used to measure volume of air involved in breathing movements.
d) Lungs are situated in the thoracic chamber which is anatomically an air tight chamber. Explain and highlight its importance in breathing.

LONG ANSWER QUESTIONS

Q1. (a)Name the muscles involved in breathing. Explain the mechanism of inspiration andexpiration. (b) Describe how is respiration regulated in humans

Q2. (a) How is oxygen transported by blood from the lungs to the tissues? (b) How is oxygen released from blood in tissues? (c) Name at least four factors which favours formation of oxyhaemoglobin.
Q3. a) Mention three layers through which act as diffusion surface between alveoli and blood.
b) What are the factors that affect the rate of diffusion between the blood and tissues?
c) Draw a neat and well labelled diagram of a section of an alveolus with a pulmonary capillary.
Q4 Draw a neat and well labeled diagram of respiratory systemAnswer.
Ans. Refer to NCERT BOOK
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CHAPTER 15:BODY FLUIDS AND CIRCULATION

BODY FLUIDS

Circulatory system consists of

heart, : The pumping organ

arteries: vessels to carry blood from heart to organs

veins : vessels to carry blood from organs to heart

capillaries: minute channels hat reach every part of body up to farthest point

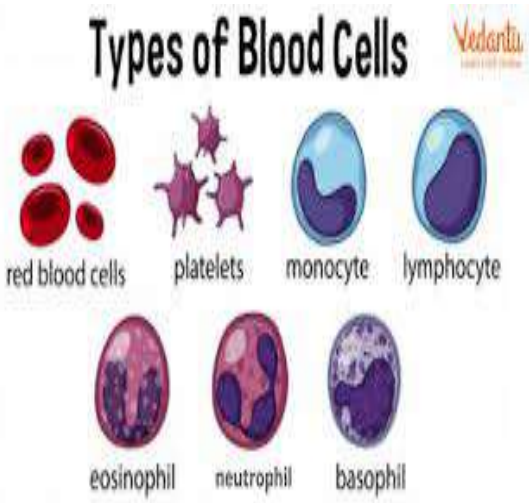
FUNCTIONS OF CIRCULATORY SYSTEM

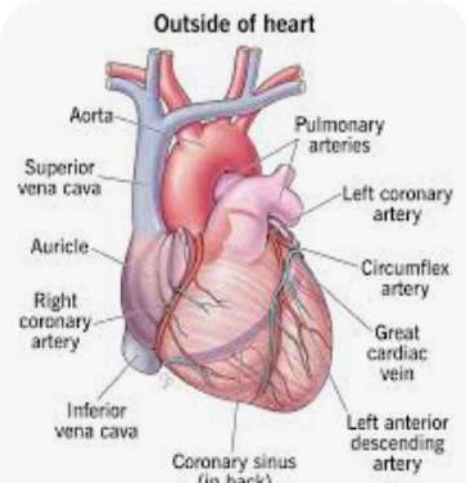
Nutrients. Nutrients are picked up from the site of digestion and transported to various parts of the body for supply to individual cells as well as sites of storage.
Respiratory Gases. The system picks up oxygen from the respiratory surface and carries it to different parts of the body for supply to individual cells. It also carries carbon dioxide from around the cells to the respiratory surface for elimination.
Waste Products. Ammonia, uric acid, urea, creatine and other toxic metabolic wastes are taken up by circulating fluid from different parts of the body to the region of elimination.
Water Balance. Water is taken out from the region of excess and replenished in the area ofdeficiency by the circulatory system.
Regulation of pH. Circulatory fluids contain buffers for regulating pH in different parts.
Metabolic Intermediates. They are taken to the area of their utilisation by circulatory system.Lactic acid is produced by muscles during intense activity. It is taken to liver by blood for further metabolism
Hormones. Endocrine glands pour their hormones into circulatory system. The system carries them to target cells, tissues and organs.
Antibodies. Immunoglobulins are present in the circulating fluid for immobilisation of toxins and microbes.
Phagocytosis. Leucocytes present in circulatory fluids phagocytose on microbes and cell wreckage.

Heat. Circulatory system distributes heat throughout the body. It also takes it to body surface

for its dissipation.

Turgidity. Turgidity of various organs of animal body including skin and sex organs is provided by circulatory system.





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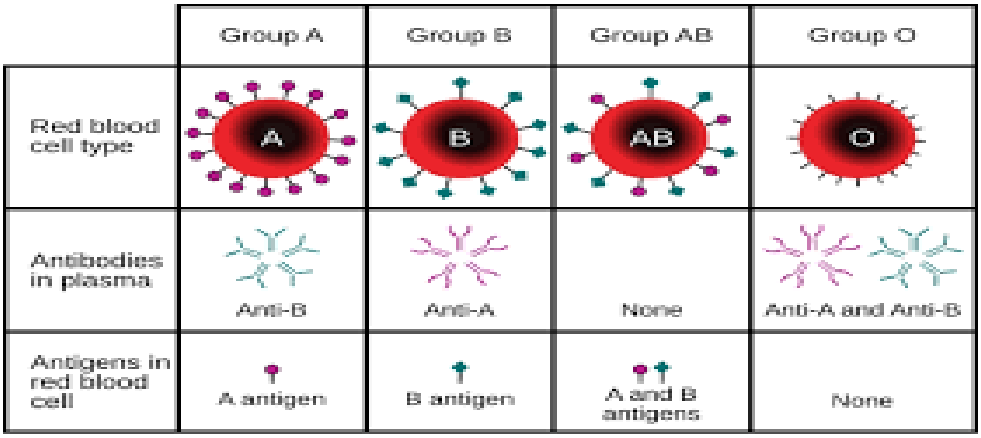
Open circulatory system	Closed circulatory system-
Examples-Arthropods and Molluscs in which blood pumped by the heart passes through the large vessels in to open spaces (or)body cavities called sinuses.	Examples-Arthropods and Molluscs in which blood pumped by the heart passes through the large vessels in to open spaces (or)body cavities called sinuses.



REGULATION OF CARDIAC CYCLE The cardiac cycle, encompassing the contraction and relaxation of the heart chambers, is regulated by a complex interplay of intrinsic and extrinsic mechanisms. The intrinsic system, primarily involving the sinoatrial (SA) node and atrioventricular (AV) node, generates and conducts electrical impulses to initiate and synchronize heartbeats. Extrinsic regulation, mediated by the autonomic nervous system and hormones, adjusts heart rate and contractility to meet the body's demands

DISORDERS OF HEART

1. **Coronary Artery Disease (CAD):** CAD results from the buildup of plaque in the arteries that supply blood to the heart, leading to reduced blood flow and potential heart attacks
2. **Angina**: chest pain or discomfort that occurs when the heart muscle is not getting enough oxygen.
3. **Hypertension (High Blood Pressure):**Hypertension is a condition where the blood pressure is consistently above the normal range
4. **Heart Failure**: Heart failure occurs when the heart muscle is unable to pump blood effectively, leading to fluid buildup in the lungs and other parts of the body

MCQs

I. Choose the best answer from the following statements

1. Blood is a kind of

(a)Fluid connective tissue (b)Liquid connective tissue
(c)Specialized connective tissue (d)All of the above
Answer-(d)

2.Leukopenia is a condition of

(a)Decrease in WBC production (b)Decrease in RBC production
(c)Increase in WBC production (d)Increase in RBC production
Answer(a)

3.HowErythro blastosisfoetalis(Haemolytic diseases of the new born) can be avoided?

(a)By administering anti-rh-antigen to mother after first delivery
(b)By administering anti-rh-antibodies to mother after first delivery
(c)By administering rh-antigen to mother after first delivery
(d)By administering rh-antibodies to mother after first delivery
Answer(b)

4. The other name of Lymph is

(a)Tissue Fluid (b)Middle man of the body
(c)Interstitial fluid (d) All of the above
Answer (d)

5. How fats are absorbed through the Lymph?

(a)Lacteals of intestinal villi (b) Chorionic villi
(c) Alveoli (d) Microvilli
Answer (a)

6 .The venous heart is present in

(a)Amphibians (b) Fishes
(c) Reptiles (d) Birds and Mammals
Ans . (b) Fishes

VERY SHORT ANSWER QUESTIONS

1.Define Lymph (or) Interstitial fluid?

Answer .As the blood passes through the capillaries in tissues , some water along with many small water soluble substances move out in to the spaces between the cells of tissues leaving the larger proteins and most of the formed elements in the blood vessels. This fluid released out is called the Lymph (or) Tissue fluid.

2. How the Heart can be protected?

Answer .The Heart can be protected by a double walled sac like structure called Pericardium which contains pericardial fluid which act as a shock absorber and protects the heart from mechanical injury , shock and reduces frictions.

3. How both atria and ventricles of the heart are separated?
Answer .By Inter atrial septum and Inter ventricular septum

5. What is the function of the semilunar valves?

Answer : That allows the flow of blood only in one direction

6. Why SANode is called a Pacemaker of the heart?

Answer :Because it is responsible for initiating and maintaining the rhythmic contractile activity of the heart

SHORT ANSWER QUESTIONS

7. .Differentiate open circulatory system with closed circulatory system.

ANS .Refer to the above text notes

8. How can you differentiate Arteries and Veins

ANS .Refer to the above text notes

9. Differentiate Lubb and Dubb

Lubb-	Dubb
*This is the first heart sound,It is the beginning of ventricular systole and it is long and dull sound *,It occurs due to the closure of bicuspid and tricuspid valves	*This is the second heart sound,It is the end of ventricular systole and it is short and sharp sound, *it occurs due to the closure of semi lunar valves

ASSERTION REASONING BASED QUESTIONS

For questions given below there are two statements marked as Assertion (A) and Reason (R). Choose the correct answer out of following choices.

Codes:

(a) If both Assertion (A) and Reason (R) are true and Reason is the correct explanation of assertion.

(b) If both Assertion (A) and Reason (R) are true, but reason is not the correct explanation of assertion.

(c) If Assertion (A) is true, reason (R) is false.

(d) If both assertion (A) and reason (R) are false

1. Assertion : WBCs accumulate at the site of wounds by diapedesis.

Reason : It is the squeezing of leucocytes from the endothelium

Answer.(b)

2. Assertion: In lymphatic system, lymph is known as tissue fluid.

Reason: It comprises of plasma proteins, RBCs and WBCs.

Answer.(c)

3. Assertion: Type ‘O’ blood group individuals are called ‘universal donors’.

Reason: RBCs of ‘O’ blood group consists both ‘A’ and ‘B’ surface antigens.

Answer. (c)

COMPETENCY BASED CASE STUDY QUESTIONS

Formed elements of blood;

Erythrocytes, leucocytes and platelets are collectively called as formed elements of blood, and they constitute nearly 45% of the blood leucocytes are also known as White Blood

Cells(WBC) as they are colourless due to the lack of haemoglobin. Blood platelets are also called Thrombocytes helpful for blood clotting (or) blood coagulation

1. Why spleen is called as the graveyard of RBC's?

Ans .RBC's have an average lifespan of 120 days after which they are destroyed in the Spleen

2. Basophils , Histamine, Serotonin and Heparin are secreted from what type of blood cells?

Ans. Basophils

3 .Mention the functions of Eosinophils

Ans . They resist infections associated with allergic reactions

4. What is the shape of the Nucleus of Eosinophils?

Ans . Horse Shoe shaped Nucleus

5. What are Megakaryocytes?

Ans .They are special cells in the bone marrow cell fragments to produce Platelets (or)Thrombocytes

ASSERTION REASONING QUESTIONS

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(d) If both assertion (A) and reason (R) are false

1. Assertion: Lymph is a colourless fluid containing specialised lymphocytes which are responsible for the immune response of the body

Reason: Lymph is an important carrieR for nUtrient, hormones, etc.

Ans both assertion and reason are true but reason is not the correct explanation of the assertion.

2. Assertion: SAN is also called pacemaker.

Reason: SAN sets the pace of the activities of the heart.

Ans A - both asseration and reason are true and the reason is the correct explanation of the assertion.

LONG ANSWER QUESTIONS

1.. Give a brief account of disorders of the human circulatory system

ANS .Refer to the above text notes

2.Draw a neat and well labeled diagram of human heart and label its parts

ANS .Refer to NCERT book and above given notes

CHAPTER: 16 EXCRETORY PRODUCTS AND THEIR ELIMINATION

EXCRETOTRY PRODUCTS

KEY POINTS TO BE REMEMBERED

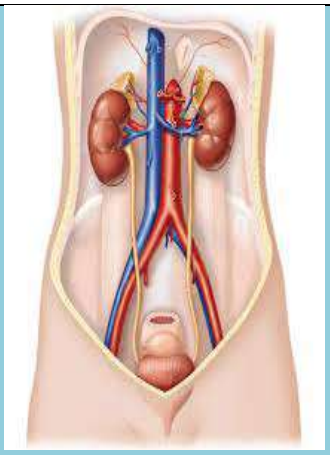
Excretion - Elimination of metaboli c wastes like ammonia, urea, uric acid etc.from the tissues.

Ammonotelism - Process of excretion of NH3. NH3 is highly toxic. So, excretion needs excess of water.

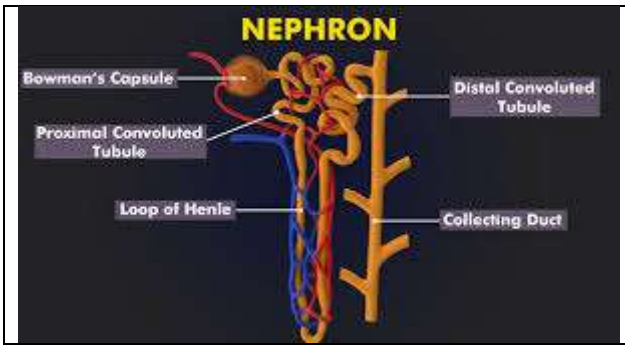
Ureotelism - Process of excretion of urea. In liver, NH3 is converted into less toxic urea. So, it needs only moderate quantity of water for excretion.
Uricotelism - Process of excretion of uric acid. It is water insoluble & less toxic. So, water is not needed for excretion.
Protonephridia (flame cells)- Excretory organs -In Flatworms.
Nephridia - Excretory organs In Annelids.
Malpighian tubules - Excretory organs: In Insects. Antennal or green glands - Excretory organs In Crustaceans
Kidneys, ureters, urinary bladder & urethra - Parts of human excretory system
Renal capsule - Kidney is enclosed in a tough, 3-layered fibrous renal capsule.
Hilum - On the concave side of kidney, there is an opening through which blood vessels, nerves, lymphatic ducts and ureter enter the kidney.
Renal pelvis - Hilum leads to funnel shaped cavity.
Medullary pyramids - Medulla has few conical projections called renal pyramids projecting into the calyces.
Nephron - Nephrons are the structural & functional units of kidney.
Glomerulus - A tuft of capillaries formed by afferent arteriole.
Malpighian body - Glomerulus + Bowman's capsule.
Renal tubule - Proximal convoluted tubule (PCT), Henle's loop & distal convoluted tubule (DCT).
Peritubular capillaries - The efferent arteriole forms a fine capillary network around the renal tubule.
Glomerular filtration - Filtration of blood through 3 layers, i.e. endothelium of glomerular blood vessels, epithelium of Bowman's capsule & a basement membrane between these 2 layers.
Glomerular filtration rate (GFR)- The amount of the filtrate formed per minute. 125 ml/minute, i.e., 180 litres/day.
Tubular Reabsorption - From the filtrate, glucose, amino acids, Na+, etc. are reabsorbed actively and nitrogenous wastes are absorbed passively. Passive reabsorption of water occurs in the initial segments of the nephron
Tubular Secretion - Cells of PCT & DCT maintain ionic (Na-K balance) and acidbase balance (pH) of body fluids by selective secretion of H+ , K+ & NH3 into the filtrate and absorption of HCO3 - from it. Counter current pattern - Henle's loop & vasa recta help to concentrate the urine.

Specific excretory organs	
Protonephridia or flame cells	Platyhelminthes, rotifers, some annelids and cephalochordate
Nephridia	Earthworms
Malpighian tubules	insects
Antennal glands	crustaceans
HUMAN EXCRETORY SYSTEM	

It consists of a pair of kidneys, one pair of ureters, a urinary bladder and a urethra.
Kidneys: reddish brown, bean-shaped structures
Size: 10-12 cm in length, 5-7 cm in width, 2-3 cm in thickness, weight: 120- 170 g.
The kidney has an outer cortex, inner medulla and pelvis. The medulla is divided into a few conical tissue
The urinary bladder opens into the urethra through which urine is expelled.
Each kidney has nearly one million nephrons (functional unitsof the kidney). The Malpighian corpuscle, PCT, DCT are situated in the cortical region while loops of Henle into
the medulla.The efferent arteriole emerging from the glomerulus forms a fine capillary network around the renal tubule called the peritubular capillaries.



FUNCTIONAL UNIT OF KIDNEY



A nephron is the fundamental functional unit of the kidney, responsible for filtering blood and producing urine. It comprises a glomerulus (a network of capillaries) and a renal tubule. This process involves filtration, reabsorption, and secretion, ultimately leading to the formation of urine and the maintenance of fluid and electrolyte balance.

MCQs

1- In which organ urea is formed
2- a- Kidney b- Liver c- Nephron d- All of these
2- Uricotelism is significant as it – a- Conserve water b- Eliminate urea
c- Eliminate methane d- Conserve nutrients
Ans: a
3- Uremia is described asa- Accumulation of uric acid in kidney b- Accumulation of urea in the bloodc- Stone in kidney d- Crystals in the kidney
Ans: b
4- The value of the GFR isa- 500 ml/ minute b- 1000 ml / minute c- 125 ml/minute d- 1 liter/ minute
Ans: c
5- Which gland is responsible for the excretiona- Sebaceous glands b- Liver c- Both a and b d- None of these
Ans: b
6- In mammalian kidneys, Bowman's capsules or Malpighian corpuscles occur in which part? a- Medulla b- Pith c- Cortex d- All are incorrect
Ans: c

Very short answer questions

1- What are the Columns of Bertini?
2- Define GFR and mention its value in healthy human beings.
3.- Write the significance of the counter-current mechanism.
4. - Where are kidneys situated in human beings?

- What are glycosuria and ketonuria?

SHORT ANSWER QUESTIONS

1. Besides many important functions Liver also helps in excretion. Explain
2. - (a) What is the Malpighian body or renal corpuscle?

(b) Name the group of animals to which Nephridia and green gland belongs.

3. - Give any three functions carried out by the kidney
4. - (a) State the importance of counter-current systems in renal functioning.

Assertion Reason Based Questions

For questions given below there are two statements marked as Assertion (A) and Reason (R). Choose the correct answer out of following choices.

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(c) If Assertion (A) is true, reason (R) is false.

(d) If both assertion (A) and reason (R) are false

Assertion : Secreting hypotonic urine is effective in reducing urinary loss of water .

Reason : Hypotonic urine is more concentrated and higher in osmotic pressure than the blood .

D both the assertion and reason are false

Assertion: Failure of secretion of hormone vasopressin causes diabetes mellitus in the patient. Reason: Vasopressin increases the volume of urine by increasing the reabsorption of water from the urine.

D both the assertion and reason are false

LONG ANSWER QUESTIONS

1.(a) Write the mechanism of action of the artificial kidney.

(b) When does a patient require kidney transplantation?

2- (a) Write the position and function of the JGA (juxtaglomerular apparatus).(b) Draw Nephron and label its following partsPart associated with secretion of urea, ascending loop of Henle, a place where glomerular filtration takes place and efferent arteriol

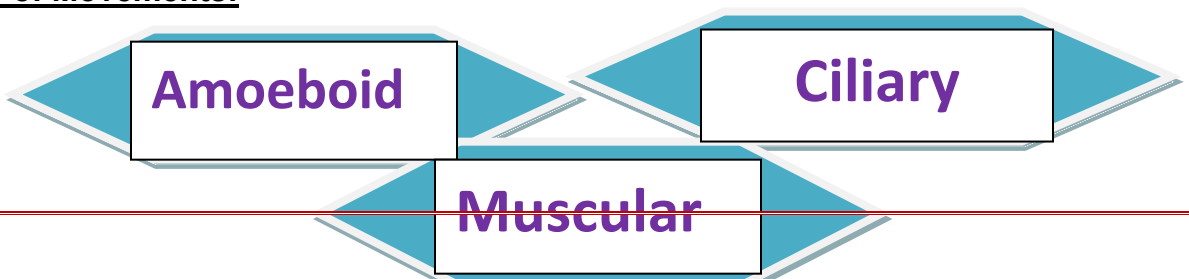
CHAPTER 17- LOCOMOTION & MOVEMENT

Main Points:

Movement: movement refers to any change in the position or posture of a living organism or its body parts.

Locomotion: locomotion specifically refers to the movement that allows an organism to change its position or move from one place to another.

Type of Movements:

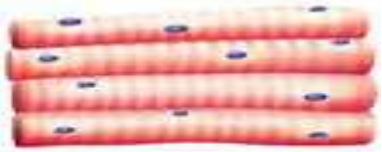
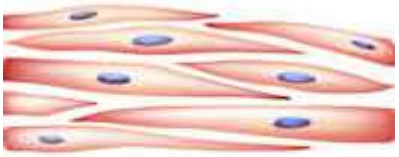
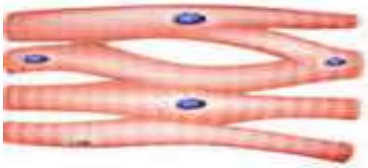


Examples 1-Amoeboid-Macrophages & Leucocytes 2 –Ciliary-In ciliated
Examples 3 - Muscular- Movement of limbs jaws, tongue etc

Muscles:

- . Muscle is a specialised tissue of mesodermal origin.
- They have special properties like excitability, contractility, extensibility and elasticity.

Types:

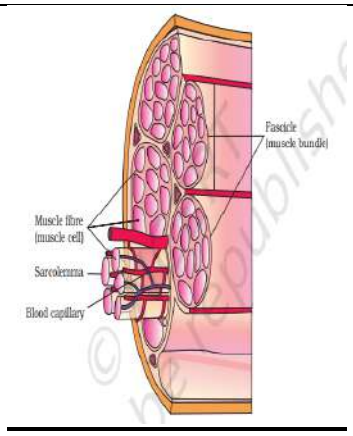
Skeletal muscles Closely associated with the skeletal components of the body. They are striated muscles. As their activities are under the voluntary control of the nervous system, they are known as voluntary muscles . They are primarily involved in locomotory actions and changes of body postures.	 Skeletal muscle
Visceral muscles Located in the inner walls of hollow visceral organs of the body like the alimentary canal, reproductive tract, etc. They are not striated & smooth in appearance. Hence, they are called smooth muscles (nonstriated muscle). Their activities are not under the voluntary control of the nervous system and are therefore known as involuntary muscles. They assist, for example, in the transportation of food through the digestive tract and gametes through the genital tract.	 Smooth muscle
Cardiac muscles(Heart Muscles). Many cardiac muscle cells assemble in a branching pattern to form a cardiac muscle. Cardiac muscles are striated. They are involuntary in nature as the nervous system does not control their activities directly.	 Cardiac muscle

Skeletal muscle

- Skeletal muscle in our body is made of a number of muscle bundles or fascicles held together by a common collagenous connective tissue layer called fascia.
- Each muscle bundle contains a number of muscle fibres
- muscle fibre is lined by the plasma membrane called sarcolemma enclosing the sarcoplasm.
- Muscle fibre is a syncitium as the sarcoplasm contains many nuclei.
- The endoplasmic reticulum, i.e., sarcoplasmic reticulum of the muscle fibres is the store house of calcium ions.

. Muscle fibre has large number of parallelly arranged filaments in the sarcoplasm called myofilaments or myofibrils.

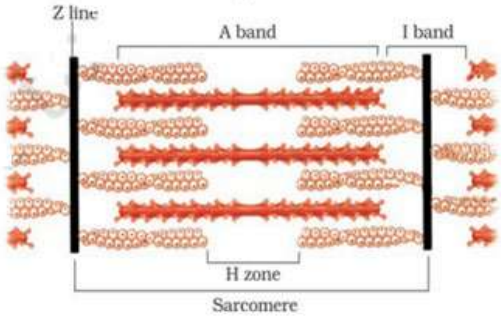
Each myofibril has alternate dark and light bands on it

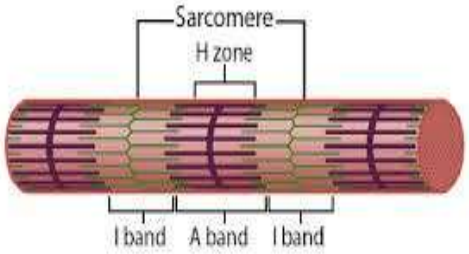


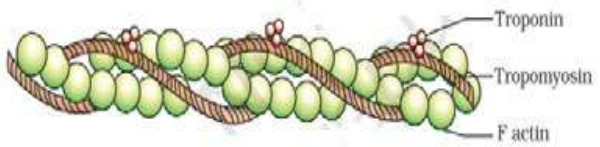
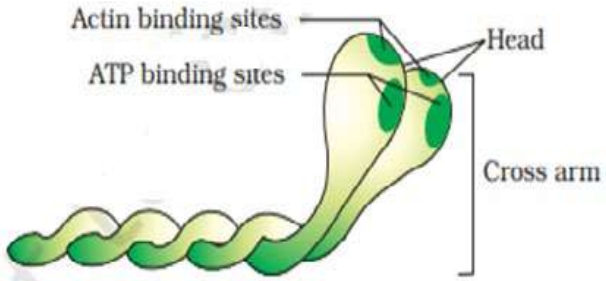
The light bands contain actin and is called I-band or Isotropic band,
the dark band called 'A' or Anisotropic band
In the centre of each 'I' band is an elastic fibre called 'Z' line which bisects it. The thin filaments are firmly attached to the 'Z' line.

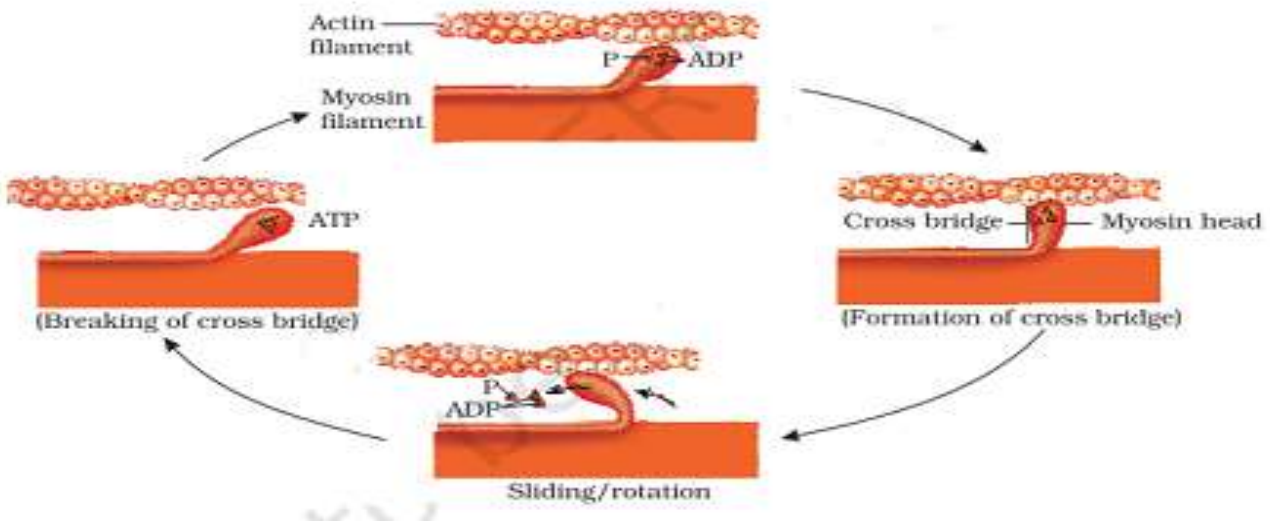
The thick filaments in the 'A' band are also held together in the middle of this band by a thin fibrous membrane called 'M' line.
The 'A' and 'I' bands are arranged alternately throughout the length of the myofibrils. The portion of the myofibril between two successive 'Z' lines is considered as the functional unit of contraction and is called a sarcomere.

In a resting state, the edges of thin filaments on either side of the thick filaments partially overlap the free ends of the thick filaments leaving the central part of the thick filaments. This central part of thick filament, not overlapped by thin filaments is called the 'H' zone.



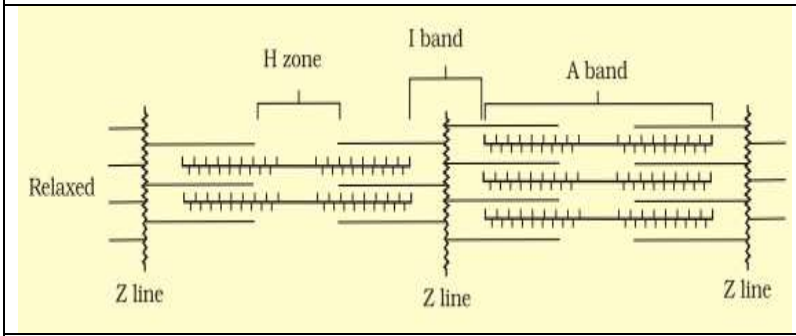
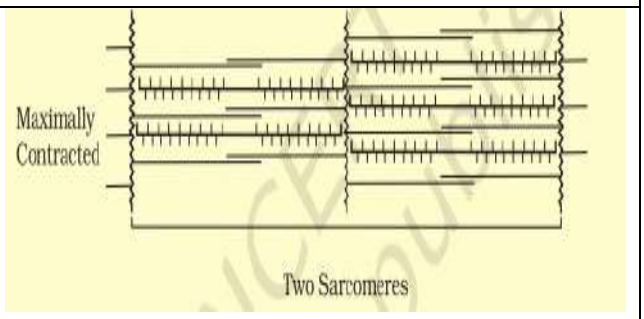


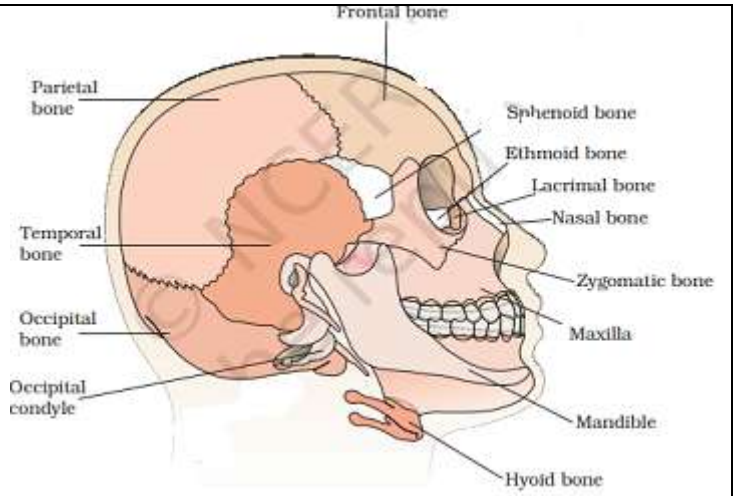
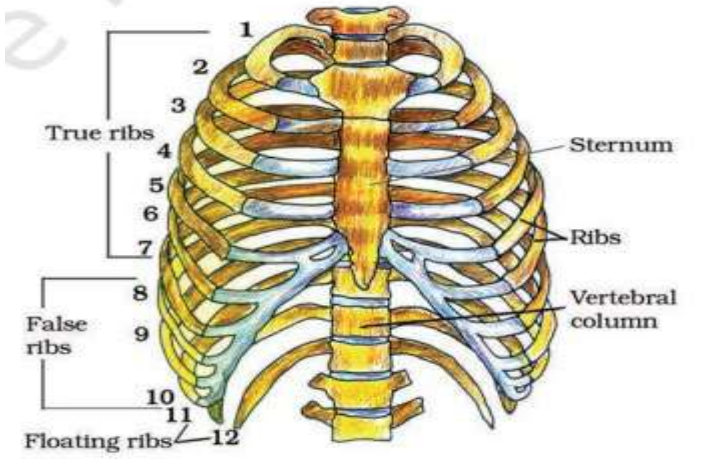
Structure of contractile protein: Actin Actin (thin) filament is made of two 'F' (filamentous) actins helically wound to each other. Each 'F' actin is a polymer of monomeric 'G' (Globular) actins. Two filaments of another protein, tropomyosin also run close to the 'F' actins throughout its length. A complex protein Troponin is distributed at regular intervals on the tropomyosin.	
Myosin Many monomeric proteins called Meromyosins constitute one thick filament. Each meromyosin has two important parts, a globular head with a short arm and a tail, the former being called the heavy meromyosin (HMM) and the latter, the light meromyosin (LMM). The globular head is an active ATPase enzyme and has binding sites for ATP and active sites for actin.	



Mechanism of muscle contraction: Muscle contraction is initiated by a signal sent by the central nervous system (CNS) via a motor neuron.

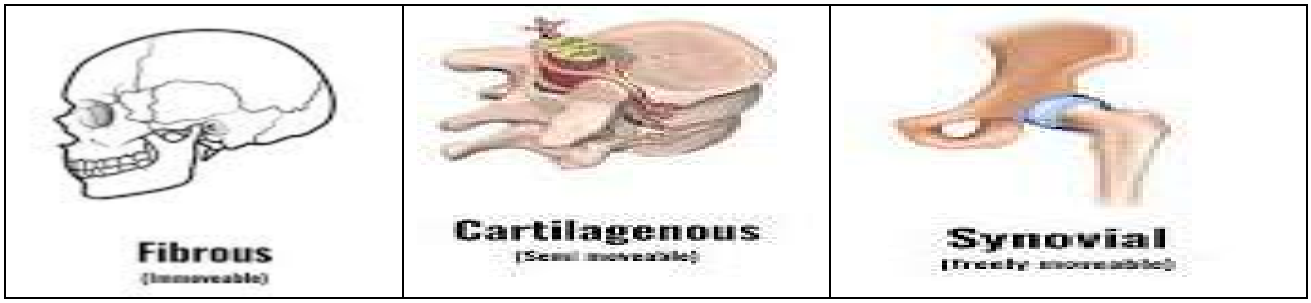
A neural signal reaching junction releases a neurotransmitter (Acetyl choline).
This generates an action potential in the sarcolemma.
This spreads through the muscle fibre and causes the release of calcium ions into the sarcoplasm.
Increase in Ca++ level leads to the binding of calcium with a subunit of troponin on actin filaments and thereby remove the masking of active sites for myosin.
Utilising the energy from ATP hydrolysis, the myosin head now binds to the exposed active sites on actin to form a cross bridge.
This pulls the attached actin filaments towards the centre of 'A' band. The 'Z' line attached to these actins are also pulled inwards thereby causing a shortening of the sarcomere, i.e., contraction.
A new ATP binds and the cross-bridge is broken . The Ca++ ions are pumped back to the sarcoplasmic cisternae resulting in the masking of actin filaments. This causes the return of 'Z' lines back to their original position, i.e., relaxation

	
Relaxed State of Muscle Sarcomere	Contracted State of Muscle Sarcomere

Skeletal System: **Total 206 bones** **Axial Skeleton (80 bones)** **1- Skull** Cranial bones are 8 in number. The facial region is made up of 14 skeletal elements which form the front part of the skull. Total 22 bones. A single U-shaped bone called hyoid is present at the base of the buccal cavity. Each middle ear contains three tiny bones – Malleus, Incus and Stapes, collectively called Ear Ossicles	
3-Ribs 12 pairs of ribs **True ribs** –First 7 Pairs **False Ribs**- 8th,9th,10th pairs Because do not articulate directly with the sternum but join the seventh rib with the help of hyaline cartilage **Floating Ribs-**Last 2 pairs (11th and 12th) of ribs are not connected ventrally and are therefore, called floating ribs. Sternum + ribs= Rib Cage	
Appendicular Skeleton 126 bones Bones of Limbs 120 Bones of Girdles 6 **Fore Limb With Pectoral Girdle** **Pectoral Girdle** Scapula -1 (one side) Clavicle -1(one side) **Fore limb-(one side)**	**Hind Limb With Pelvic Girdle** **Pelvic Girdle** Ilium-1 (one side) Ischium-1 (one side)) Pubis-1 (one side) Above three fuse to form Single bone(Coxal bone) **Hind Limb**(one side)

Fibrous joints	**Cartilaginous joints**	**Synovial joints**
Fibrous joints do not allow any movement. Example- Flat skull bones fuse end-to-end with the help of dense fibrous connective tissues in the form of sutures, to form the cranium.	In cartilaginous joints, the bones involved are joined together with the help of cartilages. Example-Joint between the adjacent vertebrae in the vertebral column	Synovial joints are characterized by the presence of a fluid filled synovial cavity between the articulating surfaces of the two bones. Example- Ball and socket joint (between humerus and pectoral girdle).

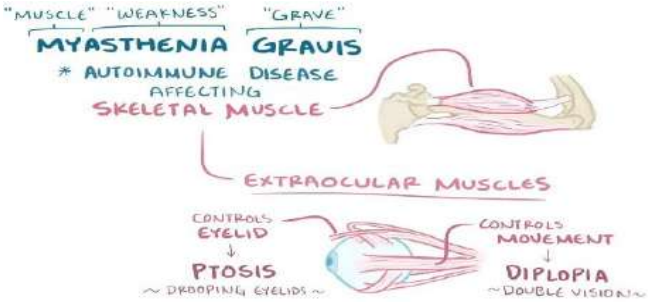
Humerus-1 Radius -1 Ulnare-1 Carpals-8 Metacarpals-5 Phalenges-14 Total =32 **Glenoid cavity-**Depression below acromian process, articulate with Humerus head	Femur -1 Tibia-1 Fibula-1 Tarsals-7 Metatarsals-5 Phalenges-14 Patella-1 Total=31 **Acetabulum**- Cavity at the point of fusion of Ilium Ischium & Pubis, articulate with Femur head.



Disorders of Muscular & Skeletal System:

Myasthenia gravis:

- Auto immune disorder affecting neuromuscular junction leading to fatigue, weakening and paralysis of skeletal muscle

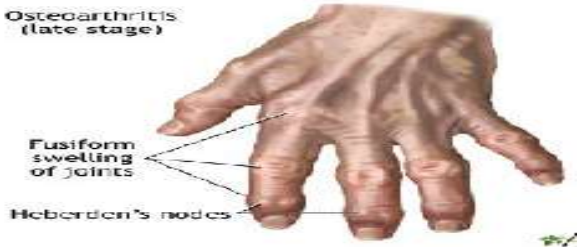


Tetany:

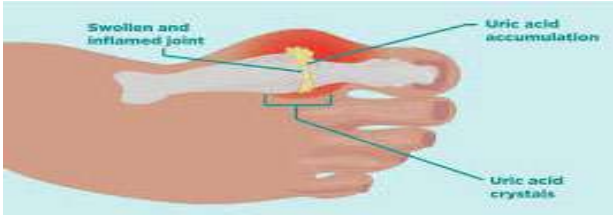
- Rapid spasms (wild contractions) in muscle due to low Ca++ in body fluid.

Arthritis:

- Inflammation of joints due to auto immune disorder.Joints become Stiff & swollen.



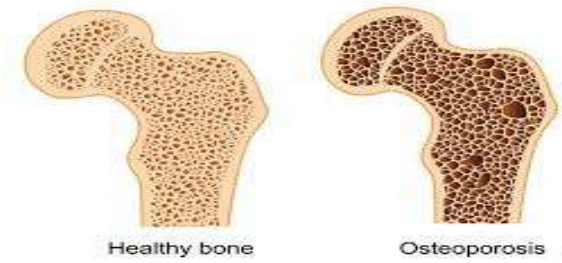
- **Gout:** Inflammation of joints due to accumulation of uric acid crystals.



Osteoporosis: Age-related disorder characterised by decreased bone mass

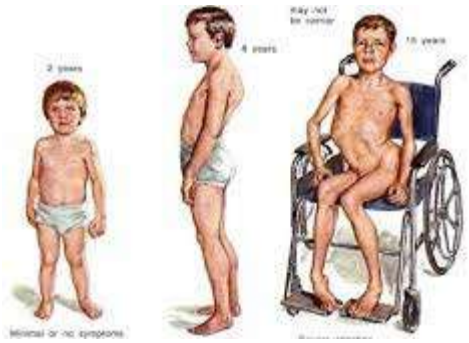
and increased chances of fractures. Decreased levels of estrogen is a

common cause.



Muscular dystrophy: Progressive degeneration of skeletal muscle mostly

due to genetic disorder.



Questions:

Multiple Choice Questions: 1 Marks

1 What is the type of movable joint present between the atlas and axis?
(a) Pivot (b) Saddle (c) Hinge (d) Gliding
Ans: (a)

2 Which one of the following is showing the correct sequential order of vertebrae in the vertebral column of human beings?
(a) Cervical — lumbar — thoracic — sacral — coccygeal
(b) Cervical — thoracic — sacral — lumbar — coccygeal
(c) Cervical — sacral — thoracic — lumbar — coccygeal
(d) Cervical — thoracic — lumbar — sacral — coccygeal
Ans: (d)

3 Q7. Which one of the following options is incorrect?
(a) Hinge joint—between humerus and pectoral girdle
(b) Pivot joint—between atlas, axis and occipital condyle
(c) Gliding joint—between the carpals
(d) Saddle joint—between carpel and metacarpals of thumb
Ans: (a)

4 Match the followings and mark the correct option.

Column I		.	Column II
A.	Sternum	(i)	Synovial fluid
B.	Glenoid cavity	(ii)	Vertebrae
C.	Freely movable joint	(iii)	Pectoral girdle
D.	Cartilaginous joint	(iv)	Flat bones

Options:
(a) A—(ii), B—(i), C—{iii), D—(iv)
(b) A—(iv), B—(iii), C—(i), D—(ii)

(c) A—(ii), B—(i), C—(iv), D—(iii)
(d) A—(iii), B—(i), C—(ii), D—(iv)
Ans. (b)

5

A & B are-?
(a) A-F actin, B-Troponin (b) A-Trpomyosin, B- Troponin
(c) A-Trponin,B- Trpomyosin (d) A-F Actin, B-Trpomyosin
Ans: (c)

Assertion Reason Questions 1 Marks

In the following questions a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.
(A) Assertion and reason both are correct statements and reason is correct explanation for assertion.
(B) Assertion and reason both are correct statements but reason is not correct explanation for assertion.
(C) Assertion is correct statement but reason is wrong statement.
(D) Assertion is wrong statement but reason is correct statement

1 Assertion: Muscle fibre is a syncytium.
Reason: A muscle fibre has many nuclei in it.
Ans.(A)

2 Assertion: The portion of myofibril between two successive Z lines is known as Sarcomere.
Reason: The portion of myofibril between two successive Z lines is known as Sarcomere.
Ans.(B)

Short Answer Type 2 Marks Questions.

1 What the disease in which the neuromuscular junction is attacked by own defense cells? What is the underlying cause?

2 With respect to rib **cage, explain the following:**
1-Floating Ribs
2-False ribs

Short Answer Type 3 Marks Questions:

1 What are the points for articulation **of pelvic and pectoral girdles?**
Ans: The components of pelvic girdle are ilium, ischium and pubis. It articulates with, femur through acetabulum. The components of pectoral girdle are scapula and clavicle. It is the glenoid cavity of pectoral girdle in which head .of humerus articulates.

2 Write a few lines about Gout.
Ans: When metabolic waste-uric acid crystals are accumulated in bones, then it results into inflammation of bone and joints thereby causing pain. This disorder of skeletal system is called gout.

Long Answer type 5 Marks Question:

1 Explain sliding filament theory of muscle contraction with neat sketches.
Ans: See The Notes

2 **(a) How is Synovial Joint different from Fibrous Joint?**

(b) What is osteoporosis? How does it happen?

(c) Write note on -

1-Ciliary movement 2- Sarcoplasmic reticulum & it role.

Ans: See the notes

Case Based Question:

1 Sarvesh lives with his parents & grandfather in nearby village. His grandfather is very old. From few days his grandfather got inflammation in his knee. The knees have became Swollen with inflammation & are also stiff. He feels pain in knee & cannot sit or stand up easily.

Answer the following Questions-

(a) What is the disease of grandfather? 1M

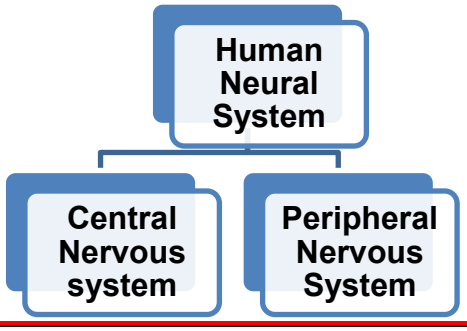
(b) How is it'caused? 1M

(c) How is it different from Gout? 2M

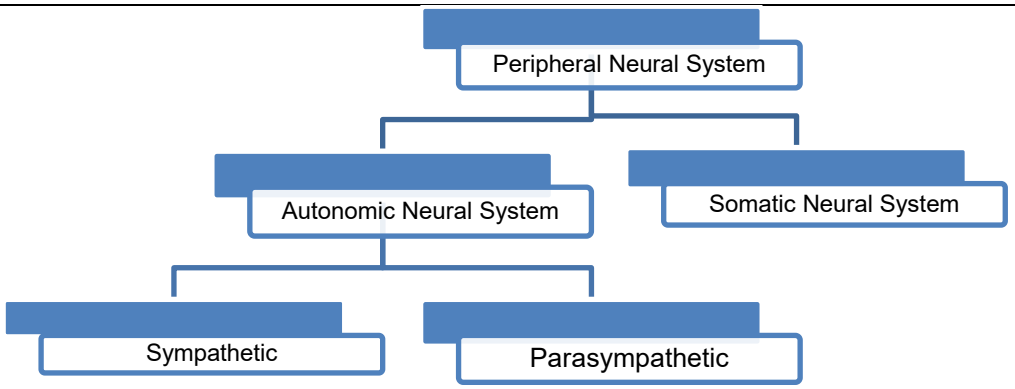
****

CHAPTER: 18 NEURAL CONTROL AND COORDINATION

• **Coordination** is the process through which two or more organs of body interact and complement the function of each other.
• **Neural system** provides an organized network of point to point connection for quick coordination. **The endocrine** system provides chemical integration through hormones.
• **Neural system** of animals is composed of specialized cells called neuron, which can detect, receive and transmit different kinds of stimuli.
• **In *Hydra*** neural system is composed of network of neuron.
• In insects it consists of brain and a number of ganglia.
• Vertebrates have highly developed neural system



- **Central Nervous System**-The CNS includes the brain and the spinal cord and is the site of information processing and control.
- **Peripheral nervous system** includes all nerves associated with CNS.
- There are two types of nerve fibres-
- **Afferent fibres** –transmit impulses from tissue/organ to CNS.
- **Efferent fibres** - transmit regulatory impulses from CNS to concerned peripheral organs.
- PNS is divided in two parts-
- **1-Somatic neural systems: It** relays impulses from CNS to skeletal muscles.
- 2-**Autonomic neural system: It** transmits impulses from CNS to involuntary system and smooth muscles.



NEURON:

NeuronasStructuralandFunctionalUnitofNeuralSystem

Neuronismadeupofthreemajorparts-**cellbody, dendrite** and**axon.**

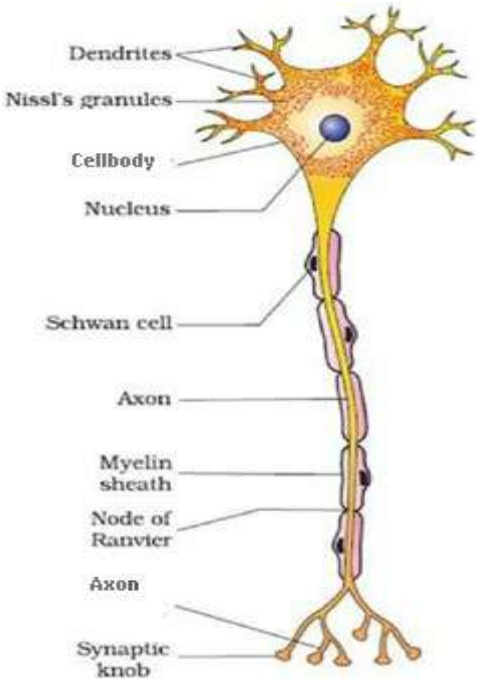
- Cell bodycontains

cytoplasm,cellorganellesand Nissl'sgranules.

- Shortfibres projectingoutfromcellbodyare calleddendrites.
- Theaxonislongfibrehaving branched structureat theendthatterminatesintoknoblikestructurecalled**synaptic knob.**
- Basedonnumberofaxonanddendritesneuronareofthreetypes-

1. **Multipolar-** oneaxonandtwoormoredendrite.Found in cerebral cortex.
2. **Bipolar-**Oneaxonandone dendrite foundinretinaofeyes.

- **Unipolar-** Cellbodywithonlyoneaxonfoundinembryonic stage



There aretwotypesofaxon-

Myelinated- fibres are enveloped with **Schwann cells** to form myelin sheath around the axon.The gap between two myelin sheaths is called **nodes of Ranvier.** Found in spinal and cranial nerves.

Unmyelinated- fibre is enclosed by Schwann cells that do not form myelin sheath around the axon. Found in autonomous and somatic neural system.

Generation and Conduction of Nerve Impulse

Neurons are excitable cells.

Resting stage

At resting stage axonal membrane is comparatively more permeable to potassium ions (K+ and nearly impermeable to sodium ions (Na+).

Similarly, the membrane is impermeable to negatively charged proteins present in the axoplasm.

The axoplasm inside the axon contains high concentration of K + and negatively charged proteins and low concentration of Na+.So overall charge is negative in side membrane.

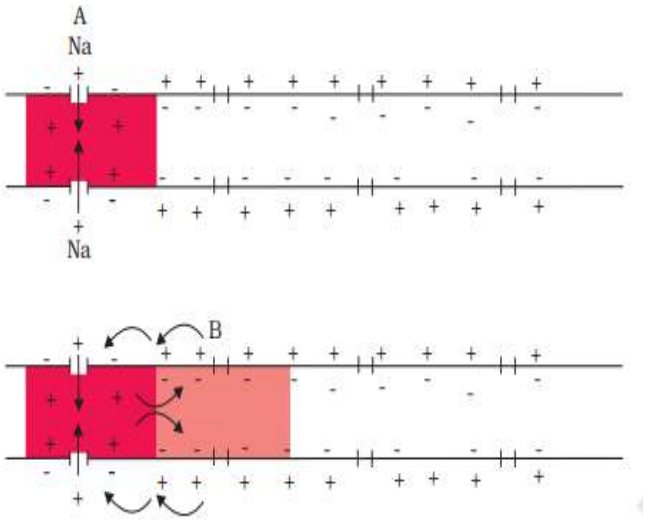
In contrast, the fluid outside the axon contains a low concentration of K + , a high concentration of Na+ and thus a concentration gradient is formed. So there is overall Positive Charge outside the Axolemma.

Sodium-potassium pump transports 3 Na + outwards for 2 K + into the cell maintains this.

Therefore Axolemma is, polarised. The electrical potential difference across the resting plasma membrane is called as the **resting potential**. .

When a stimulus is applied at a site on the polarised membrane, the membrane at the site A becomes freely permeable to Na+ This leads to a rapid influx of Na+ followed by the reversal of the polarity at that site, reversed and hence depolarised.

The electrical potential difference across the plasma membrane at the site A is called the **action potential**, (**nerve impulse**). At sites immediately ahead, the axon (e.g., site B) membrane has a positive charge on the outer surface and a negative charge on its



Nerve Impulse Conduction Through Axon

further stimulation.

Synapse

Thejunction between two neurons is called synapse.

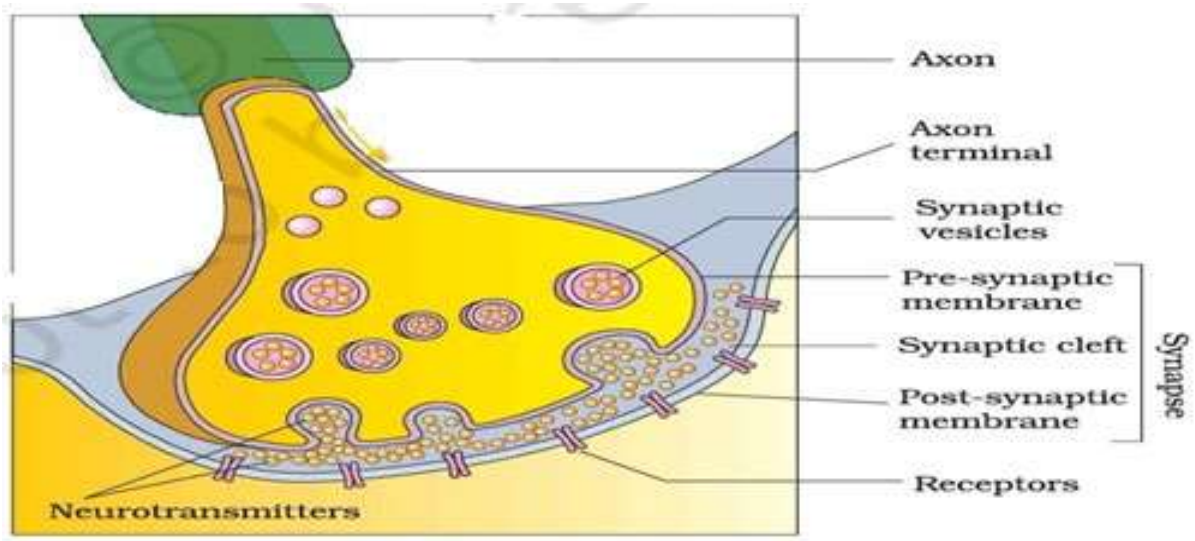
- Therearetwotypesofsynapse-

1. **Electricalsynapse-** themembraneofpreandpostsynapticneuronisveryclosetoeach other and current flow directly from one neuron to another.
2. **Chemicalsynapse-**preandpostsynaptic neuronisseparatedbyfluidfilledspacecalled synaptic cleft.

   Synapticcleft: The gap between pre & post synaptic membrane is called Synaptic cleft.

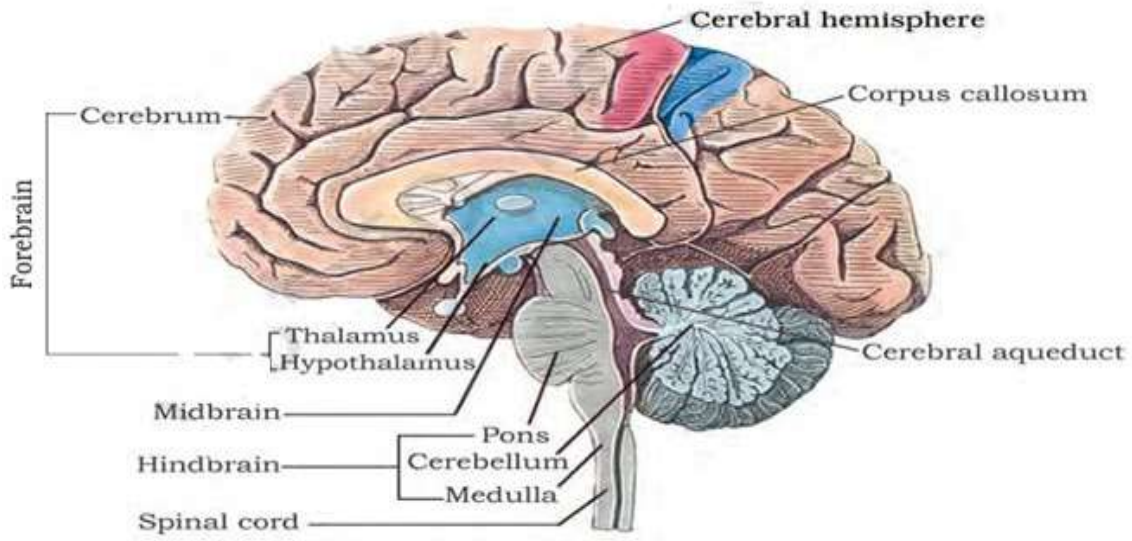
Neurotransmittersareinvolvedintransmissionofimpulses through chemical synapse.

inner surface. As a result, a local current flows on the inner surface from site A to site B. On the outer surface current flows from site B to site A. Hence, the polarity at the site is reversed, and an action potential is generated at site B. Thus, the impulse (action potential) generated at site A arrives at site B. The sequence is repeated along the length of the axon and consequently the impulse is conducted. K+ diffuses outside the membrane and restores the resting potential of the membrane at the site of excitation and the fibre becomes once more responsive to	When an impulse (action potential) arrives at the axon terminal, it stimulates the movement of the synaptic vesicles towards the membrane where they fuse with the plasma membrane and release their neurotransmitters in the synaptic cleft. The released neurotransmitters bind to their specific receptors, present on the post-synaptic membrane.



- **Transmission of Nerve Impulse Through Synapse**

Central Neural System- Brain is the central information processing organ of our body and act as command and control centre. Human brain is protected by skull (cranium) and three layers of cranial meninges- outer dura mater, middle arachnoid and inner piamater



The brain can be divided into three major parts:

(i) Forebrain,

(ii) Midbrain

(iii) Hindbrain

Forebrain- consists of **cerebrum, thalamus and hypothalamus.** Cerebrum is divided into left and right cerebral hemispheres which are joined by **corpus callosum**
Cerebral cortex contains sensory neuron, motor neuron and association area. Association area controls complex functions like inter sensory associations, memory and communication.
Thalamus- cerebrum wraps around a structure called thalamus. It is a major coordinating centre for sensory and motor signaling.
Hypothalamus controls the urge for eating, drinking and body temperature. They also release hypothalamic hormones. Limbic system is involved in controlling sexual behavior and expression of emotional reactions.
Midbrain-located between hypothalamus and pons of hindbrain.
Dorsal portion consists of four round lobes called **corpora quadrigemina.**
They are involved in relay of impulses back and forth between cerebrum, cerebellum, Pons and medulla.
The midbrain receives and integrates visual, tactile and auditory inputs.

Hindbrain-

Consists of **Pons, medulla oblongata** and **cerebellum.**
Pons consists of fibre tracts that interconnect different regions of the brain.

The medulla contains centres which control respiration, cardiovascular reflexes and gastric secretions.

The cerebellum integrates information received from the semicircular canals of the ear and the auditory system&controls balance and posture.

Questions:

Multiple Choice Questions 1Marks

1	**The function of our visceral organs is controlled by** **(a) Sympathetic and somatic neural system** **(b) Sympathetic and parasympathetic neural system** **(c) Central and somatic neural system.** **(d) None of the above** **Ans:** (b)
2	**An area in the brain which is associated with strong emotions is** **(a) Cerebral cortex (b) Cerebellum** **(c) Limbic system (d) Medulla** **Ans:** (c)
3	**Resting membrane potential is maintained by** **(a) Hormones (b) Neurotransmitters** **(c) Ion pumps (d) None of the above** **Ans:** (c)
4	**Which one is not true-** **(a) Acetylcholine is neurotransmitter** **(b) hypothalamus controls the body temperature** **(c) The hindbrain comprises pons, cerebrum and medulla** **(d) None of the above** **Ans:** (c)
5	**Which of the following is not a part of a neuron?** **a) Cell body** **b) Sarcolemma** **c) Dendrites** **d) Axon** **Ans.(b)**
	Assertion Reason Type Question:
	In the following questions a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices. **(A) Assertion and reason both are correct statements and reason is correct explanation for assertion.** **(B) Assertion and reason both are correct statements but reason is not correct explanation for assertion.** **(C) Assertion is correct statement but reason is wrong statement.** **(D) Assertion is wrong statement but reason is correct statement.**
1	**Assertion**: Axolemma is permeable to negatively charged proteins present in the Axoplasm. **Reason**: Sodium-potassium pump transports 3 Na + outwards for 2 K + into the cell. **Ans (D)**
2	**Assertion**: Neurotransmitters are necessary in the transmission of impulses through chemical synapses. **Reason**: At a chemical synapse, the membranes of the pre- and post-synaptic neurons are separated by a fluid-filled space called synaptic cleft Ans: (A)

	Short answer Type 2 Marks:
1	**What do grey and white matter in the brain represent?** **Ans:** The layer of cells which covers the cerebral hemisphere is called cerebral cortex and is thrown into prominent folds. The cerebral cortex is referred to as the grey matter due to its greyish appearance. The neuron cell bodies are concentrated here giving the colour. Fibres of the tracts are covered with the myelin sheath, which constitute the inner part of cerebral hemisphere. They give an opaque white appearance to the layer and, hence, is called the white matter.
2	**Neural system and computers share certain common features. Comment in five lines. (Hint: CPU, input-output devices).** **Ans:** Neural system and computers share certain common features. The neural system has brain as command and control centre similar to the computer that has CPU (Central processing unit). Sensory organs are input devices of neural system like the mouse and keyboard of the computer. Responses of the body are the output of the neural system like the data analysis and typed material of the computer. Nerves are comparable to the wires of the computers.
	Short answer Type 3 Marks:
1	**If someone receives a blow on the back of** neck**, what would be the effect on the person's CNS?** **Ans**: If someone receives a blow on the back of neck, it may result in the dislocation of the cervical vertebrae that may lead to the injury of the spinal cord passes through neural canal. It may adversely affect the functioning of heart & respiratory system. Injury of spinal cord may lead to paralysis.
2	**Draw a well labeled diagram of a typical neuron.Label any six parts.** **Ans: See the note.**
	Long Answer Type 5 Marks Questions.
1	**Explain the process of the formation &transport of nerve impulse through a synapse with the help of a labelled diagram showing an axon terminal and synapse.** **Ans. See The Note.**
2	**Name the parts of human forebrain indicating their respective functions.** **Ans: See the Note**
	Case Based Question: 4 Marks
1	**Prateek was feeling very thirsty & hungry in noon as he was engaged in urgent work & could not take breakfast today. He asked his mother to provide him lunch immediately as he was very hungry.** **Answer the following questions-** **(a) Name the part of human brain that controls the thirst & hunger. 1 M** **(b) In which part of brain it is located. 1 M** **(c) Write down main works of cerebellum. 2 M**

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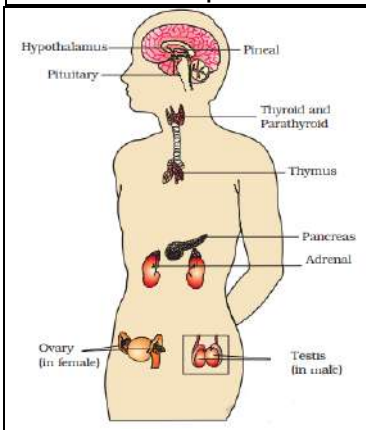
CHAPTER -19 CHEMICAL COORDINATION & INTEGRATION

Endocrine Glands / Ductless Glands: The glands having no ducts to pass their secretion & directly pour their secretion in to blood are called Endocrine gland or Ductless gland. They secrete Hormones.

Hormone: Hormones are non-nutrient chemicals which act as intercellular messengers and are produced in trace amounts.



Endocrine System of Body

- **Hypothalamus**
- **Pineal Gland**
- **Pituitary Gland**
- **Thyroid Gland**
- **Para Thyroid Gland**
- **Thymus**
- **Pancreas**
- **Adrenal Gland**
- **Ovary**
- **Testes**

Others

- HEART
- KIDNEY
- GASTROINTESTINAL TRACT

Hypothalamus

Neurosecretory cells of hypothalamus secrete hormones Two type of hormones-

- **Releasing type (Stimulate secretion of pituitary hormones)**
- **Inhibiting type(Inhibit secretion of pituitary hormones)**

Releasing typeGrowth Hormone-Releasing Hormone (GHRH): Stimulates the pituitary gland to release growth hormone, which is essential for growth and development.

Thyrotropin-Releasing Hormone (TRH): Triggers the pituitary gland to release thyroid-stimulating hormone (TSH), which regulates thyroid function.

Gonadotropin-Releasing Hormone (GnRH): Signals the pituitary gland to produce follicle-stimulating hormone (FSH) and luteinizing hormone (LH), which are crucial for reproductive processes.

Corticotropin-Releasing Hormone (CRH): Stimulates the pituitary gland to release adrenocorticotropic hormone (ACTH), which plays a role in the body's response to stress.

Inhibiting type

Somatostatin: Inhibits the release of various hormones, including growth hormone and thyroid-stimulating hormone.

Dopamine: Inhibits the release of prolactin, a hormone involved in milk production.

These hormones reach the pituitary gland through a portal circulatory system and regulate the functions of the anterior pituitary. The posterior pituitary is under the direct neural regulation of the hypothalamus.

Pituitary Gland:

Hormones & their Function

Situated in Sella Tursica(Bony Cavity) below hypothalamus

1-Adenohypophysis

A. Pars Distalis (Anterior Pituitary)

1. **Growth Hormone(GH)-**

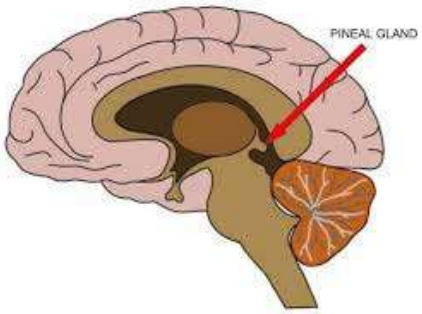
Stimulates growth of body. Oversecretion results in gigantism, excess secretion in adults causes Acromegaly.

2. **Prolactin (PL)-**Regulates growthof mammary gland & formation of milk.
3. **Thyroid Stimulating Hormone (TSH)-**stimulates secretion of thyroid hormones from thyroid gland.
4. **Adrenocorticotrophic Hormone (ACTH)-**stimulates secretion of glucocorticoids (steroid) from adrenal cortex.
5. **Lutinising Hormone(LH)-**
6. **Follicle Stimulating Hormone-**
   LH &FSH both Stimulate gonadal activity called gonadotrophin
   In male LH stimulates androgen secretion & FSH stimulate spermatogenesis.
   In Females LH induces ovulation
   & FSHstimulates development of follicles

Pineal Gland:

Secretes **Melatonin hormone**

Function- 24 hour rhythm of body regulation viz. Sleep wake cycle, body temperature, metabolism, pigmentation, menstrual cycle, & body defense.



Pancreas:

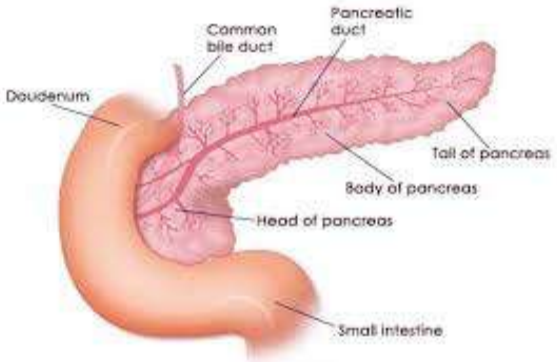
Mix Gland= Endocrine + Exocrine

1-Glucagon -α Cells of islet of Langerhans secrete it- causes hyperglycemia by stimulating glycogenolysis, reduce cellular uptake of glucose.

2- Insulin-β cells of islet of Langerhans secrete Insulin.

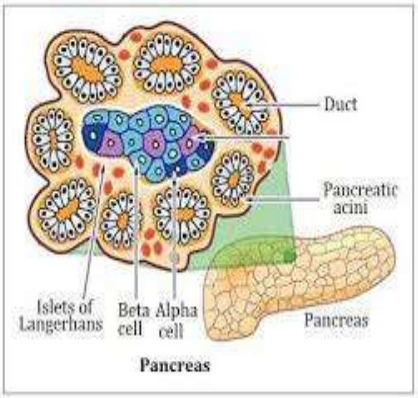
Insulin acts on hepatocyte & adipocyte & enhances cellular uptake & utilization of glucose & also causes glycogenesis.

(So hypoglycemic)Both hormones together maintain glucose level of body



Diabetes Mellitus

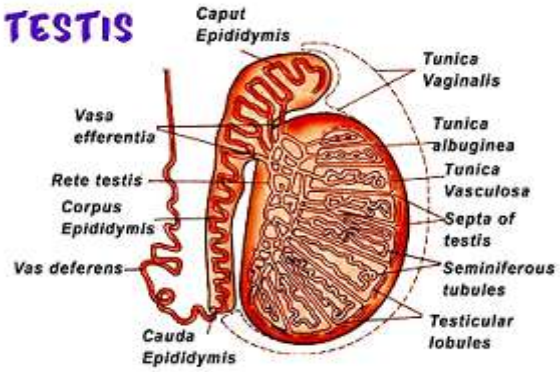
Due to low secretion of Insulin hyperglycemia occur & Glucose is lost through urine, Ketone bodies are formed



Testis:

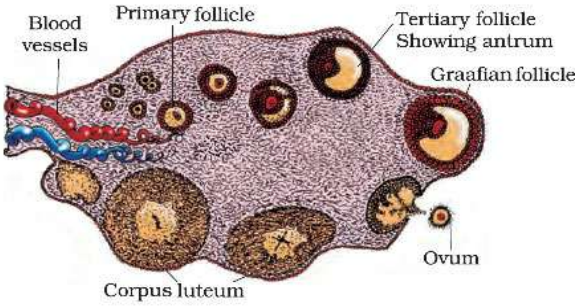
Leydig's cell secrete –Androgens viz. **Testosterone**

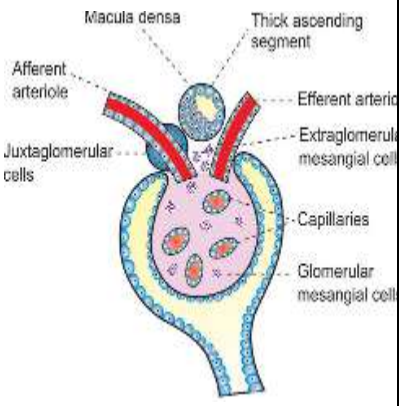
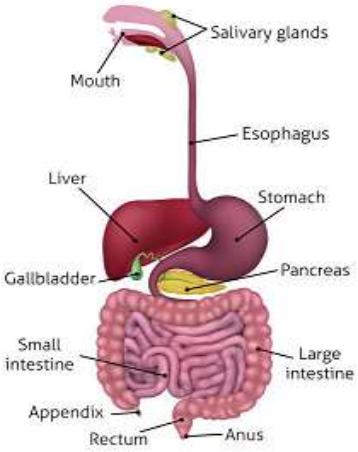
Regulate development maturation & functioning of accessary sex organs, growth of facial & axillary hair, spermatogenesis, and male sexual behaviour.

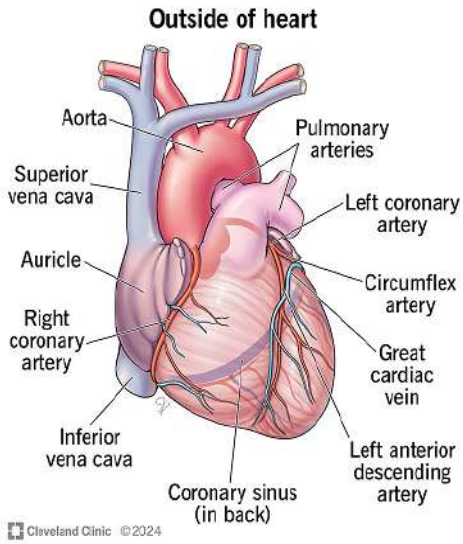


Ovary:

1-Ovarian Follicles secrete –**Estrogen**

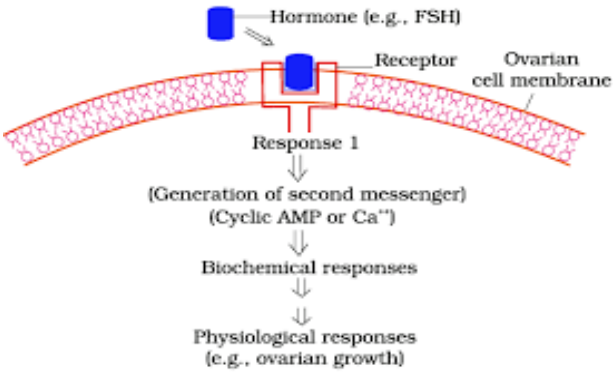
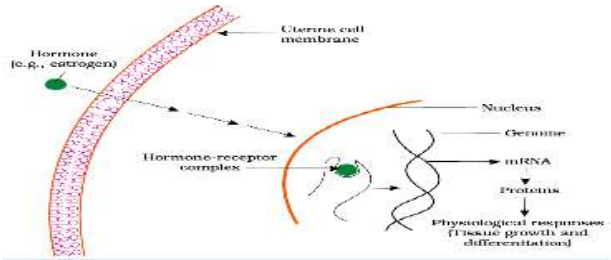
Stimulates of female secondary sex organs, development of ovarian follicles, high pitch voice, mammary gland delopment & regulatefemale sexual behaviour. 2- Corpus luteum secrete **Progesterone** Supports pregnancy (pregnancy hormone) Stimulates formation of alveoli in mammary gland & milk Secretion.	 **OVARY**

Heart	**Kidney**	**GI Tract**
Atrial wall of heart secrete **atrial natriuretic factor (ANF)** Reduces blood pressure by vasodilatation	**JGA** of kidney secrete **Erythropoietin** hormone • Stimulates Erythropoiesis 	**1-Gastrin-**stimulates secretion of HCl & Pepsinogen by gastric gland. **2-Secretin-**stimulate pancreas to secretewater & bicarbonate ions **3-Cholecystokinin-**stimulate both pancreas & gall bladder ,stimulate seretion of pancreatic enzyme & bile juice. **4-Gastric inhibitory peptide-** inhibit gastric secretion & motility. 

- Many non endocrine tissues release growth factors which stimulate toissue growth & repair.

Mechanism of Hormonal Action:

A Some hormones which interact with membrane-bound receptors normally do not enter the target cell, but generate second messengers (e.g., cyclic AMP, IP3 , Ca++ etc) which in turn regulate cellular metabolism. Example. FSH  **Questions** **Multiple Choice Questions 1 Marks**	**B Some hormones** which interact with intracellular receptors (e.g., steroid hormones, iodothyronines, etc.) mostly regulate gene expression or chromosome function by the interaction of hormone-receptor complex with the genome. Cumulative biochemical actions result in physiological and developmental effects .  Options: (a) A—(iv), B—(ii), C—(iii), D—(i)

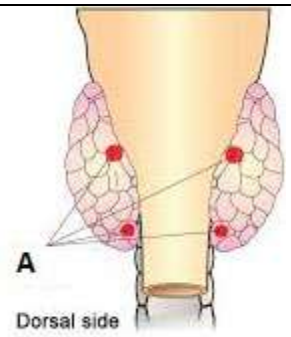
1. **Select the right match of endocrine gland and their hormones among the options given below.**

A.	Pineal	(i)	Epinephrine
B.	Thyroid	(ii)	Melatonin
C.	Ovary	(iii)	Estrogen
D.	Adrenal medulla	(iv)	Tetraiodothyronine

(b) A—(ii), B—(iv), C—(i), D—(iii)
(c) A—(iv), B—(ii), C—(i), D—(iii)
(d) A—(ii), B—(iv), C—(iii), D—(i)

Ans (d)

2	**Which of the following hormones is not secreted by anterior pituitary?** **(a) Growth hormone (b) Follicle stimulating hormone** **(c) Vasopressin (d) Adrenocorticotrophic hormone** **Ans (c)**
3	**The steroid hormone produced in adrenal cortex responsible for balance of water and electrolytes in our body is-** **(a) Insulin (b) Melatonin (c) Testosterone (d) Aldosterone** **Ans (d)**
4	**A man is suffering from frequent urination & dehydration but there is no loss of sugar through urine. The hormone & disease for this is-** **(a) Insulin & diabetes mellitus (b) Melatonin& diabetes incipidus (c) Testosterone& Diabetes mellitus (d) Vasopressin & Diabetes incipidus.** **Ans. (d)**
5	**Hormones are called chemical signals that stimulate specific target tissues. Which is the correct location of these receptors in** case **of protein hormones?** **(a)** Extra cellular **matrix** **(b) Blood** **(c) Plasma membrane** **(d) Nucleus** **Ans: (c)**
	Assertion Reason Type Question:
6	In the following questions a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices. (A) Assertion and reason both are correct statements and reason is correct explanation for assertion. (B) Assertion and reason both are correct statements but reason is not correct explanation for assertion. (C) Assertion is correct statement but reason is wrong statement. (D) Assertion is wrong statement but reason is correct statement.
6	**Assertion**: Catecholamines are called fight or flight hormones: **Reason**: Noradrenalin or norepinephrine Both hormones rapidly release in emergency situation. **Ans (A)**
7	Assertion: **α** Cells of iIslet of Langerhans in pancreas secrete Insulin .

	Reason: Insulin is Hypoglycemic hormone which increases uptake of glucose by cells. Ans: (D)
	Short answer Type 2 Marks:
	Certain hormones do not enter in side target cell but still they produce effect? How is it possible?
	Immune system in old people generally becomes weak. Is there any Endocrine gland related to this if yes then write gland is related & how?
	Short answer Type 3 Marks:
	Inflammatory responses can be controlled by a certain steroid. Name the steroid, its source and also its other important functions.
	 **In above diagram recognise & write the name of endocrine gland. Write the name of Hormone secreted by the gland & it's function.**
	Long Answer Type 5 Marks Questions.
1	**Hypothalamus secretes hormones Which control the Other Endocrine Glands Justify your answer with examples.** **Ans. See The Note.**
2	**There are two ways of mechanism of action of Hormones. Explain with Diagram.** **Ans See the Note.**
	Case Based Question: 4 marks
1	**Ritik on the way of school saw a man with Enlarged & bulging out area of neck in front side of throat. The eyes of the man were bulging out. The neck was deformed.** **Give the answer to following questions-** **(a) What is the name of disease? 1M** **(b) Write name of the gland who is involved in this disease. 1M** **(c) What is the cause of this deformity in the man? What precaution should be taken to avoid this disease? 2 M** **Ans: See the notes.**

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SESSION ENDING EXAMINATION
CLASS XI BIOLOGY (044)

Maximum Marks: 70 **Time: 3 hours**

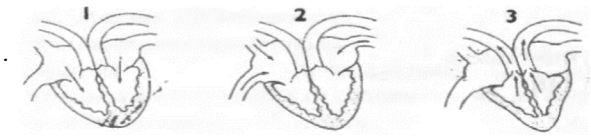
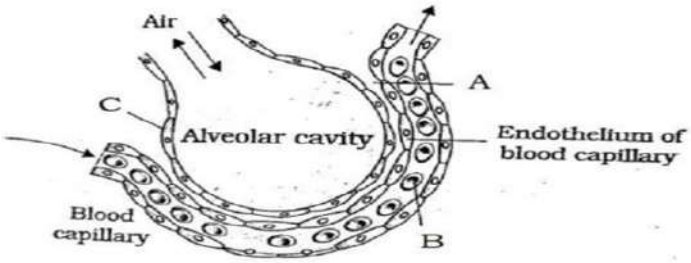
General Instructions:

1. All questions are compulsory.

2. The question paper has five sections and 33 questions.

3. All questions are compulsory. Section–A has 16 questions of 1 mark each; Section–B has 5 questions of 2 marks each; Section– C has 7 questions of 3 marks each; Section– D has 2 case-based questions of 4 marks each; and Section–E has 3 questions of 5 marks each.
4. There is no overall choice. However, internal choices have been provided insome questions. A student has to attempt only one of the alternatives in such questions.
Wherever necessary, neat and properly labeled diagrams should be drawn.

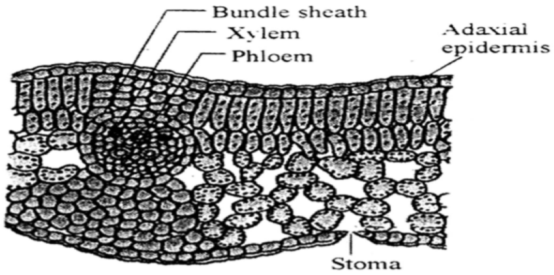
1	What is true about *Mangifera indica Linn*? A. Mangifera is the species name. B. Linn is the generic name. C. Indica is the specific epithet. D. Mangifera is the name of author	1M
2	The book written by Linnaeus is- A. Systema Naturae B. Origin of species C. Philosophic Zoologic D. None of these	1M
3	The following figures respectively represent. A. Chlamydomonas, Volvox, Chara B. Chara, Volvox, Chlamydomonas C. Volvox, Chlamydomonas, Chara D. Volvox, Chara, Chlamydomonas	1M
4	Presence of stiff cellulose plates on the outer surface of the cell wall is a characteristic feature of-. A.Slime moulds B. Dinoflagellates C. Euglenoids D. Flagellated protozoans	1M
5	Match the following: 1.Hypogynous — a. Plum 2.Perigynous — b.Cucumber 3.Epigynous — c. China rose A.1 – b, 2 – c, 3 – a B.1 – c, 2 – a, 3 – b C.1 – b, 2 – a, 3 – c D.1 – a, 2 – c, 3 – b	1M
6	In female frog, cloaca receives- A .Ureter, bidder's canal and rectum B. Ureter, oviduct and rectum C.Urino no-genital duct, oviduct and rectum D. Uri no-genital duct, bidder's canal and rectum	1M
7	Select the group which contains all secondary metabolites- A. Anthocyanin, vitamins, glucose, lipids B. Morphine, Abrin, Vinblastin, Carotenoids C.Glucose, codeine, RNA, gums D.Curcumin, ricin, amino acids, rubber	1M

8	The accompanying diagram shows three stages in the cardiac cycle- Which of the following sequence is correct?  A.2,3,1 B. 1,2,3 C. 2, 1, 3 D. 3, 1, 2	1M
9	Study the given figure and identify A to C.  (table below)	1M
10	Following is the figure of actin (thin) filaments. Identify A, B and C. A)A- Tropomyosin, B - Troponin, C - F-actin B)A- Troponin, B -Tropomyosin, C – Myosin C) A- Troponin, B - Myosin, C – Tropomyosin D) A- Troponin, B -Tropomyosin, C - F-actin	1M
11	What is the function of the Calvin cycle? A.Produce ATP and NADPH B.Fix carbon dioxide into organic molecules C.Split water molecules D. Release oxygen	1M
12	Juvenile plasticity in leaf is seen in- A. Coriander B. Buttercup C. Larkspur D.Both A and C.	1M

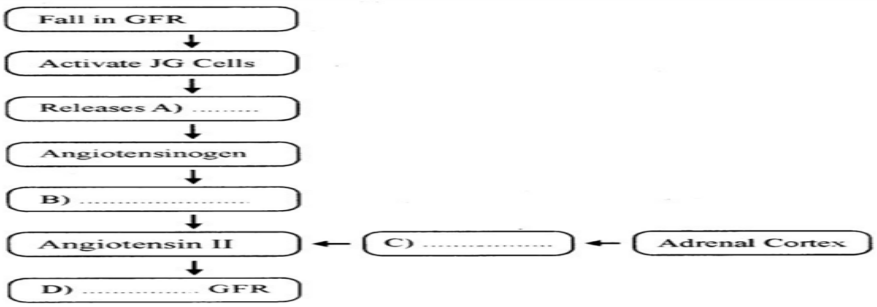
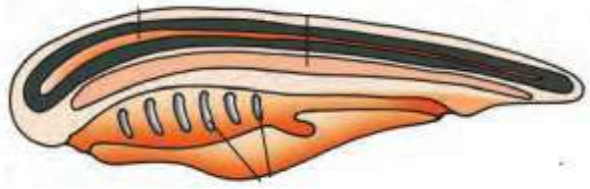
	1	2	3
A	Basement membrane	RBC	Alveolar wall
B	O2	CO2	Alveolar O2
C	Pleura	RBC	Pericardium
D	Pleura	WBC	Pulmonary vein

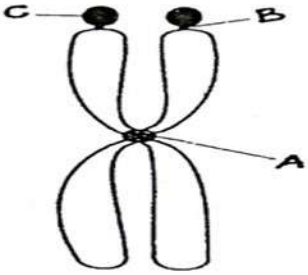
	For Questions number 13 to 16, two statements are given one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below- **(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).** **(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).** **(C) Assertion (A) is true, but Reason (R) is false.** **(D) Assertion (A) is false, but Reason (R) is true.**	
13	Assertion: Reptiles are homoiothermous animals. Reason: They are not able to maintain a constant body temperature.	1M
14	Assertion: Small disc shaped structures at the surface of the centromeres are called kinetochores. Reason: Kinetochores serve as the sites of attachment of spindle fibers to the centromeres	1M
15	Assertion: Decapitation is widely used in tea plantation and hedge making. Reason: Removal of shoot tips usually results in the growth of lateral buds	1M
16	Assertion (A): About 70% of CO_2 that enters RBCs changes into HCO_3^- for transport in plasma to the lungs where it reconverts into CO_2 for elimination. Reason (R): About 40% of CO_2 that enters RBCs changes into carbamino-haemoglobin which releases O_2 in the lungs.	1M

	SECTION-B	
17	Give reason- A. Sea appears red (red tides). B. Deuteromycetes known as imperfect fungi. C. Diatoms form diatomaceous earth. D. Viruses did not find a place in classification	2M
18	The male and female frog can be identified by the difference in their morphological features- A. Name this phenomenon. B. Give two differences between male and female frogs.	2M
19	Draw the structure of alanine amino acid and ribose sugar.	2M
20	Plant growth regulators (PGRs) have innumerable practical applications. Name the PGR you should use to- A.Nutrientmobilisation. B. Female flowers in cucumbers. C .Promotes bolting. D. Respiratory climactic.	2M
21	What is stroke volume? What is its relation with cardiac output? OR What is neuromuscular junction and how a neural signal causes the release of calcium ions into the Sarcoplasmic reticulum.	2M
	SECTION- C	
22	The predominant stage of the life cycle of moss is the gametophyte which consists of two stages. A. What are these two stages and how they developed?	3M

	B. Name two examples of mosses.	
23	Observe the given figure-  Write any three features on mesophyll cell from this figure.	3M
24	Observe the figures A and B. A. Identify the aestivation A and B. B.Write one example and one peculiarity of A. C.Name the three kinds of petal	3M
25	Non-protein constituents called cofactors are bound to the enzyme to make the enzyme catalytically active. A. Name the protein portion of enzyme. B. What happens to the catalytic activity when the cofactor is removed from the enzyme? C. Mention any two kinds of cofactors with examples. OR A. Identify the sub stages of meiosis in which following events occurs- 1.Synapsis 2.Terminalisation of chiasmata. 3. Appearance of recombination nodules. Crossing over. B. Write one significance of meiosis in sexually reproducing organisms.	3M
26	There are different types of plastids in plant cells. Name them and write their functions.	3M

28	How a nerve impulse is transmitted across a synaptic cleft?	3M
	SECTION- D	
27	(a) In what kind of plants do you come across Kranz anatomy? (b)To which conditions are those plants better adapted? (c)How are these plants better adapted than the plants, which lack this anatomy?	3M

29	Study the equation given below and answer the following questions: Mg+2 Pyruvic acid+ CoA+ NAD+ → AcetylCoA+CO2+NADH+H+ A. Name the type of reaction and where does it take place? B. Why this process does not take place in the cytoplasm of eukaryotes? C.Name the enzyme (A) involved in the reaction.What is the fate of Acetyl CoA formed?	3M
30	The functioning of the kidneys is efficiently monitored and regulated by hormonal feedback mechanisms involving the hypothalamus, JGA and to a certain extent, the heart. A. Complete the flow chart showing the regulation of kidney functioning by JGA and adrenal cortex. B.Explain how the functioning of kidney isregulated by heart.  C.Name the hormone which facilitates water reabsorption from latter parts of tubule, thereby preventing diuresis.	
31	The following diagram shows the characteristic feature of a phylum.  A. Name the phylum and mention four salient features of this phylum. B. Give an outline sketch of classification of this phylum up to classes. OR A. Differentiate between Chondrichthyes and Osteichthyes. B. Mention flight adaptation in birds.	5M
32	The nucleoplasm contains small spherical shaped structures. A. Name the structures and their function. B. Name the openings seen in nuclear envelope and state their function. C. Name the type of chromosomes on the basis of position of centromere and label the parts A, B and C.	

	 OR Explain the fluid mosaic model plasma membrane with the help of diagram and explain different modes of transport by giving examples	
33	Show the diagrammatic representation of the mechanism of the hormone action: A. Protein hormone B. Steroid hormone OR Describe the importance of hormones and endocrine glands responsible for regulating the Calcium Homeostasis of plasma with the help of diagram and explain different modes of transport by giving examples.	

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