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S.No.	PREPARED BY	SCHOOL	TOPICS
1)	**Kulwant Rai Puri**	FFAS Govt. Model Co. Ed. Sr. Sec School, Ladowali Road Jal.	Compilation, brief up of all chapters. LEP The Living world, Biological Classification
2)	**Rebecca Sagar**	GMSSSS PAP CAMPUS Jal.	Compilation and Review
3)	**Ranjit Singh**	GSSS Purkhali, Ropar	Plant Kingdom
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10)	**Ranjit Singh**	GSSS Purkhali, Ropar	Breathing and exchange of gases, Body fluids and its circulation
11)	**Sanjay Kaplish**	GSSS Dher	Excretory Products and their elimination, Locomotion and movement
12)	**Rani Devi**	GSSS Phoolpur Grewal	Neural control and coordination, Chemical coordination and integration

UNDER THE GUIDANCE OF:
Ms. Vijay Bangla
PDM Biology, (G)GSSS Nangal, Ropar
Science.
Mr.Dharampal Singh,
PDM Biology, GSSS Mehsampur,Jal.

UNDER THE SUPERVISION OF:
Ms. Jasvinder Kaur
Asst. Project Director Sen. Sec.

CHAPTER WISE BRIEF NOTES

UNIT I DIVERSITY IN THE LIVING WORLD

Chapter 1: The Living World

The living world is rich in variety. Millions of plants and animals have been identified and described but a large number still remains unknown. In order to facilitate the study of kinds and diversity of organisms, biologists have evolved certain rules and principles for identification, nomenclature and classification of organisms. The branch of knowledge dealing with these aspects is referred to as **taxonomy**. The taxonomic studies of various species of plants and animals are useful in agriculture, forestry, industry and in general for knowing our bio-resources and their diversity. The basics of taxonomy like identification, naming and classification of organisms are universally evolved under international codes. Based on the resemblances and distinct differences, each organism is identified and assigned a correct scientific/biological name comprising two words as per the **binomial system of nomenclature**. An organism represents /occupies a place or position in the system of classification. There are many categories / ranks and are generally referred to as taxonomic categories or taxa. All the categories constitute a taxonomic hierarchy.

Chapter 2: Biological Classification

Biological classification of plants and animals was first proposed by **Aristotle** on the basis of simple morphological characters. **Linnaeus** later classified all living organisms into two kingdoms – Plantae and Animalia. **Whittaker** proposed an elaborate five kingdom classification – Monera, Protista, Fungi, Plantae and Animalia. The main criteria of the five-kingdom classification were cell structure, body organization, mode of nutrition and reproduction, and phylogenetic relationships.

In the five-kingdom classification, bacteria are included in Kingdom Monera. Bacteria are cosmopolitan in distribution. These organisms show the most extensive metabolic diversity. Bacteria may be autotrophic or heterotrophic in their mode of nutrition. Kingdom Protista includes all single-celled eukaryotes such as Chrysophytes, Dinoflagellates, Euglenoids, Slime-moulds and Protozoans. Protists have defined nucleus and other membrane bound organelles. They reproduce both asexually and sexually. Members of Kingdom Fungi show a great diversity in structures and habitat. Most fungi are saprophytic in their mode of nutrition. They show asexual and sexual reproduction. Phycomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes are the four classes under this kingdom. The plantae include all eukaryotic chlorophyll-containing organisms. Algae, bryophytes, pteridophytes, gymnosperms and angiosperms are included in this group. The life cycle of plants exhibits alternation of generations – gametophytic and sporophytic generations. The heterotrophic eukaryotic, multicellular organisms lacking a cell wall are included in the Kingdom Animalia. The mode of nutrition of these organisms is holozoic. They reproduce mostly by the sexual mode. Some acellular organisms like viruses and viroids as well as the lichens are not included in the five-kingdom system of classification.

Chapter 3: Plant Kingdom

Plant kingdom includes algae, bryophytes, pteridophytes, gymnosperms and angiosperms. Algae are chlorophyll-bearing simple, thalloid, autotrophic and largely aquatic organisms. Depending on the type of pigment possesed and the type of stored food, algae are classfied into three classes, namely Chlorophyceae, Phaeophyceae and Rhodophyceae. Algae usually reproduce vegetatively by fragmentation, asexually by formation of different types of spores and sexually by formation of gametes which may show isogamy, anisogamy or oogamy.

Bryophytes are plants which can live in soil but are dependent on water for sexual reproduction. Their plant body is more differentiated than that of algae. It is thallus-like and prostrate or erect and attached to the substratum by rhizoids. They possess root-like, leaf-like and stem like structures. The bryophytes are divided into liverworts and mosses. The plant body of liverworts is thalloid and dorsiventral whereas mosses have upright, slender axes bearing spirally arranged leaves. The main plant body of a bryophyte is gamete-producing and is called a gametophyte. It bears the male sex organs called antheridia and female sex organs called archegonia. The male and female gametes produced fuse to form zygote which produces a multicellular body called a sporophyte. It produces haploid spores. The spores germinate to form gametophytes.

In pteridophytes the main plant is a sporophyte which is differentiated into true root, stem and leaves. These organs possess well-differentiated vascular tissues. The sporophytes bear sporangia which produce spores. The spores germinate to form gametophytes which require cool, damp places to grow. The gametophytes bear male and female sex organs called antheridia and archegonia, respectively. Water is required for transfer of male gametes to archegonium where zygote is formed after fertilization. The zygote produces a sporophyte.

The gymnosperms are the plants in which ovules are not enclosed by any ovary wall. After fertilization the seeds remain exposed and therefore these plants are called naked-seeded plants. The gymnosperms produce microspores and megaspores which are produced in microsporangia and megasporangia borne on the sporophylls.

The sporophylls – microsporophylls and megasporophylls – are arranged spirally on axis to form male and female cones, respectively. The pollen grain germinates and pollen tube releases the male gamete into the ovule, where it fuses with the egg cell in archegonia. Following fertilization, the zygote develops into embryo and the ovules into seeds.

The angiosperms are divided into two classes – the dicotyledons and the monocotyledons.

Chapter 4: Animal Kingdom

The basic fundamental features such as level of organization, symmetry, cell organization, coelom, segmentation, notochord, etc., have enabled us to broadly classify the animal kingdom. Besides the fundamental features, there are many other distinctive characters which are specific for each phyla or class.

Porifera includes multicellular animals which exhibit cellular level of organisation and have characteristic flagellated choanocytes. The coelenterates have tentacles and bear cnidoblasts. They are mostly aquatic, sessile or free-floating. The ctenophores are marine animals with comb plates. The platyhelminths have flat body and exhibit bilateral symmetry. The parasitic forms show distinct suckers and hooks. Aschelminthes are pseudocoelomates and include parasitic as well as non-parasitic roundworms.

Annelids are metamerically segmented animals with a true coelom. The arthropods are the most abundant group of animals characterised by the presence of jointed appendages. The molluscs have a soft body surrounded by an external calcareous shell. The body is covered with external skeleton made of chitin. The echinoderms possess a spiny skin. Their most distinctive feature is the presence of water vascular system. The hemichordates are a small group of worm-like marine animals. They have a cylindrical body with proboscis, collar and trunk.

Phylum Chordata includes animals which possess a notochord either throughout or during early embryonic life. Other common features observed in the chordates are the dorsal, hollow nerve cord and paired pharyngeal gill slits. Some of the vertebrates do not possess jaws (Agnatha) whereas most of them possess jaws (Gnathostomata). Agnatha is represented by the class, Cyclostomata. They are the most primitive chordates and are ectoparasites on fishes. Gnathostomata has two super classes, Pisces and Tetrapoda. Classes Chondrichthyes and Osteichthyes bear fins for locomotion and are grouped under Pisces. The Chondrichthyes are fishes with cartilaginous endoskeleton and are marine. Classes, Amphibia, Reptilia, Aves and Mammalia have two pairs of limbs and are thus grouped under Tetrapoda. The amphibians have adapted to live both on land and water. Reptiles are characterised by the presence of dry and cornified skin. Limbs are absent in snakes. Fishes, amphibians and reptiles are poikilothermous (cold-blooded). Aves are warm-blooded animals with feathers on their bodies and forelimbs modified into wings for flying. Hind limbs are adapted for walking, swimming, perching or clasping. The unique features of mammals are the presence of mammary glands and hairs on the skin. They commonly exhibit viviparity.

UNIT II STRUCTURAL ORGANISATION IN PLANTS AND ANIMALS

Chapter 5: Morphology of Flowering Plants

Flowering plants exhibit enormous variation in shape, size, structure, mode of nutrition, life span, habit and habitat. They have well developed root and shoot systems. Root system is either tap root or fibrous. Generally, dicotyledonous plants have tap roots while monocotyledonous plants have fibrous roots. The roots in some plants get modified for storage of food, mechanical support and respiration. The shoot system is differentiated into stem, leaves, flowers and fruits. The morphological features of stems like the presence of nodes and internodes, multicellular hair and positively phototropic nature help to differentiate the stems from roots. Leaf is a lateral outgrowth of stem developed exogenously at the node. These are green in color to perform the function of photosynthesis. Leaves exhibit marked variations in their shape, size, margin, apex and extent of incisions of leaf blade (lamina).

The flower is a modified shoot, meant for sexual reproduction. The flowers are arranged in different types of inflorescences. They exhibit enormous variation in structure, symmetry, position of ovary in relation to other parts, arrangement of petals, sepals, ovules etc. After fertilization, the ovary is modified into fruits and ovules into seeds. Seeds either may be monocotyledonous or dicotyledonous. They vary in shape, size and period of viability. The floral characteristics form the basis of classification and identification of flowering plants. This can be illustrated through semitechnical descriptions of families. Hence, a flowering plant is described in a definite sequence by using scientific terms. The floral features are represented in the summarized form as floral diagrams and floral formula.

Chapter 6: Anatomy of Flowering Plants

Anatomically, a plant is made of different kinds of tissues. The plant tissues are broadly classified into meristematic (apical, lateral and intercalary) and permanent (simple and complex). Assimilation of food and its storage, transportation of water, minerals and photosynthates, and mechanical support are the main functions of tissues. There are three types of tissue systems – epidermal, ground and vascular. The epidermal tissue systems are made of epidermal cells, stomata and the epidermal appendages. The ground tissue system forms the main bulk of

the plant. It is divided into three zones – cortex, pericycle and pith. The vascular tissue system is formed by the xylem and phloem. On the basis of presence of cambium, location of xylem and phloem, the vascular bundles are of different types. The vascular bundles form the conducting tissue and translocate water, minerals and food material.

Monocotyledonous and dicotyledonous plants show marked variation in their internal structures. They differ in type, number and location of vascular bundles. The secondary growth occurs in most of the dicotyledonous roots and stems.

Chapter 7: Structural Organization in Animals

Cells, tissues, organs and organ systems split up the work in a way that ensures the survival of the body as a whole and exhibit division of labour. A tissue is defined as group of cells along with intercellular substances performing one or more functions in the body. Epithelia are sheet like tissues lining the body's surface and its cavities, ducts and tubes. Epithelia have one free surface facing a body fluid or the outside environment. Their cells are structurally and functionally connected at junctions.

The Indian bullfrog, *Rana tigrina*, is the common frog found in India. Body is covered by skin. Mucous glands are present in the skin which is highly vascularized and helps in respiration in water and on land. Body is divisible into head and trunk. A muscular tongue is present, which is bilobed at the tip and is used in capturing the prey. The alimentary canal consists of esophagus, stomach, intestine and rectum, which open into the cloaca. The main digestive glands are liver and pancreas. It can respire in water through skin and through lungs on land. Circulatory system is closed with single circulation. RBCs are nucleated. Nervous system is organized into central, peripheral and autonomic. The organs of urinogenital system are kidneys and urinogenital ducts, which open into the cloaca. The male reproductive organ is a pair of testes. The female reproductive organ is a pair of ovaries. A female lays 2500-3000 ova at a time. The fertilization and development are external. The eggs hatch into tadpoles, which metamorphose into frogs.

UNIT III CELL: STRUCTURE AND FUNCTIONS

Chapter 8: Cell: The Unit of Life

All organisms are made of cells or aggregates of cells. Cells vary in their shape, size and activities/functions. Based on the presence or absence of a membrane bound nucleus and other organelles, cells and hence organisms can be named as eukaryotic or prokaryotic.

A typical eukaryotic cell consists of a cell membrane, nucleus and cytoplasm. Plant cells have a cell wall outside the cell membrane. The plasma membrane is selectively permeable and facilitates transport of several molecules. The endomembrane system includes ER, Golgi complex, lysosomes and vacuoles. All the cell organelles perform different but specific functions. Centrosome and centriole form the basal body of cilia and flagella that facilitate locomotion. In animal cells, centrioles also form spindle apparatus during cell division. Nucleus contains nucleoli and chromatin network. It not only controls the activities of organelles but also plays a major role in heredity.

Endoplasmic reticulum contains tubules or cisternae. They are of two types: rough and smooth. ER helps in the transport of substances, synthesis of proteins, lipoproteins and glycogen. The Golgi body is a membranous organelle composed of flattened sacs. The secretions of cells are packed in them and transported from the cell. Lysosomes are single membrane structures containing enzymes for digestion of all types of macromolecules. Ribosomes are involved in protein synthesis. These occur freely in the cytoplasm or are associated with ER. Mitochondria help in oxidative phosphorylation and generation of adenosine triphosphate. They are bound by double membrane; the outer membrane is smooth and inner one folds into several cristae. Plastids are pigment containing organelles found in plant cells only. In plant cells, chloroplasts are responsible for trapping light energy essential for photosynthesis. The grana, in the plastid, is the site of light reactions and the stroma of dark reactions. The green colored plastids are chloroplasts, which contain chlorophyll, whereas the other colored plastids are chromoplasts, which may contain pigments like carotene and xanthophyll. The nucleus is enclosed by nuclear envelope, a double membrane structure with nuclear pores. The inner membrane encloses the nucleoplasm and the chromatin material. Thus, cell is the structural and functional unit of life.

Chapter 9: Biomolecules

A closer examination reveals that the relative abundance of carbon, hydrogen and oxygen is higher in living systems when compared to inanimate matter. The most abundant chemical in living organisms is water. There are thousands of small molecular weights (<1000 Da) biomolecules. Amino acids, monosaccharide and disaccharide sugars, fatty acids, glycerol, nucleotides, nucleosides and nitrogen bases are some of the organic compounds seen in living organisms. There are 20 types of amino acids and 5 types of nucleotides. Fats and oils are glycerides in which fatty acids are esterified to glycerol. Phospholipids contain, in addition, a phosphorylated nitrogenous compound.

Only three types of macromolecules, i.e., proteins, nucleic acids and polysaccharides are found in living systems. Lipids, because of their association with membranes separate in the macromolecular fraction.

Biomacromolecules are polymers. They are made of building blocks which are different. Proteins are heteropolymers made of amino acids. Nucleic acids (RNA and DNA) are composed of nucleotides. Biomacromolecules have a hierarchy of structures – primary, secondary, tertiary and quaternary. Nucleic acids serve as genetic material. Polysaccharides are components of cell wall in plants, fungi and also of the exoskeleton of arthropods. They also are storage forms of energy (e.g., starch and glycogen). Proteins serve a variety of cellular functions. Many of them are enzymes, some are antibodies, some are receptors, some are hormones and some others are structural proteins. Collagen is the most abundant protein in animal world and Ribulose bisphosphate Carboxylase-Oxygenase (RuBisCO) is the most abundant protein in the whole of the biosphere.

Enzymes are proteins which catalyze biochemical reactions in the cells. Ribozymes are nucleic acids with catalytic power. Proteinaceous enzymes exhibit substrate specificity, require optimum temperature and pH for maximal activity. They are denatured at high temperatures. Enzymes lower activation energy of reactions and enhance greatly the rate of the reactions. Nucleic acids carry hereditary information and are passed on from parental generation to progeny.

Chapter 10: Cell Cycle and Cell Division

According to the cell theory, cells arise from preexisting cells. The process by which this occurs is called cell division. Any sexually reproducing organism starts its life cycle from a single-celled zygote. Cell division does not stop with the formation of the mature organism but continues throughout its life cycle. The stages through which a cell passes from one division to the next is called the cell cycle. Cell cycle is divided into two phases called (i) Interphase – a period of preparation for cell division, and (ii) Mitosis (M phase) – the actual period of cell division. Interphase is further subdivided into G1, S and G2. G1 phase is the period when the cell grows and carries out normal metabolism. Most of the organelle duplication also occurs during this phase. S phase marks the phase of DNA replication and chromosome duplication. G2 phase is the period of cytoplasmic growth. Mitosis is also divided into four stages namely prophase, metaphase, anaphase and telophase. Chromosome condensation occurs during prophase. Simultaneously, the centrioles move to the opposite poles. The nuclear envelope and the nucleolus disappear and the spindle fibers start appearing. Metaphase is marked by the alignment of chromosomes at the equatorial plate. During anaphase the centromeres divide and the chromatids start moving towards the two opposite poles. Once the chromatids reach the two poles, the chromosomal elongation starts, nucleolus and the nuclear membrane reappear. This stage is called the telophase. Nuclear division is then followed by the cytoplasmic division and is called cytokinesis. Mitosis thus, is the equational division in which the chromosome number of the parent is conserved in the daughter cell.

In contrast to mitosis, meiosis occurs in the diploid cells, which are destined to form gametes. It is called the reduction division since it reduces the chromosome number by half while making the gametes. In sexual reproduction when the two gametes fuse the chromosome number is restored to the value in the parent. Meiosis is divided into two phases – meiosis I and meiosis II. In the first meiotic division the homologous chromosomes pair to form bivalents, and undergo crossing over. Meiosis I has a long prophase, which is divided further into five phases. These are leptotene, zygotene, pachytene, diplotene and diakinesis. During metaphase I the bivalents arrange on the equatorial plate. This is followed by anaphase I in which homologous chromosomes move to the opposite poles with both their chromatids. Each pole receives half the chromosome number of the parent cell. In telophase I, the nuclear membrane and nucleolus reappear. Meiosis II is similar to mitosis. During anaphase II the sister chromatids separate. Thus, at the end of meiosis four haploid cells are formed.

UNIT IV PLANT PHYSIOLOGY

Chapter 11: Photosynthesis in Higher Plants

Green plants make their own food by photosynthesis. During this process carbon dioxide from the atmosphere is taken in by leaves through stomata and used for making carbohydrates, principally glucose and starch. Photosynthesis takes place only in the green parts of the plants, mainly the leaves. Within the leaves, the mesophyll cells have a large number of chloroplasts that are responsible for CO_2 fixation. Within the chloroplasts, the membranes are sites for the light reaction, while the chemosynthetic pathway occurs in the stroma. Photosynthesis has two stages: the light reaction and the carbon fixing reactions. In the light reaction the light energy is absorbed by the pigments present in the antenna, and funneled to special chlorophyll a molecules called reaction centre chlorophylls. There are two photosystems, PS I and PS II. PS I has a 700 nm absorbing chlorophyll a P700 molecule at its reaction centre, while PS II has a P680 reaction centre that absorbs red light at 680 nm. After absorbing light, electrons are excited and transferred through PS II and PS I and finally to NAD forming NADH. During this process a proton gradient is created across the membrane of the thylakoid. The breakdown of the protons gradient due to movement through the F0 part of the ATPase enzyme releases enough energy for synthesis of ATP. Splitting of water molecules is associated with PS II resulting in the release of O_2 , protons and transfer of electrons to PS II.

In the carbon fixation cycle, CO_2 is added by the enzyme, RuBisCO, to a 5- carbon compound RuBP that is converted to 2 molecules of 3-carbon PGA. This is then converted to sugar by the Calvin cycle, and the RuBP is regenerated. During this process ATP and NADPH synthesised in the light reaction are utilised. RuBisCO also

catalyses a wasteful oxygenation reaction in C_3 plants: photorespiration. Some tropical plants show a special type of photosynthesis called C_4 pathway. In these plants the first product of CO_2 fixation that takes place in the mesophyll, is a 4-carbon compound. In the bundle sheath cells the Calvin pathway is carried out for the synthesis of carbohydrates.

Chapter 12: Respiration in Plants

Plants unlike animals have no special systems for breathing or gaseous exchange. Stomata and lenticels allow gaseous exchange by diffusion. Almost all living cells in a plant have their surfaces exposed to air.

The breaking of C-C bonds of complex organic molecules by oxidation cells leading to the release of a lot of energy is called cellular respiration. Glucose is the favored substrate for respiration. Fats and proteins can also be broken down to yield energy. The initial stage of cellular respiration takes place in the cytoplasm. Each glucose molecule is broken through a series of enzyme catalyzed reactions into two molecules of pyruvic acid. This process is called glycolysis. The fate of the pyruvate depends on the availability of oxygen and the organism. Under anaerobic conditions either lactic acid fermentation or alcohol fermentation occurs. Fermentation takes place under anaerobic conditions in many prokaryotes, unicellular eukaryotes and in germinating seeds. In eukaryotic organisms aerobic respiration occurs in the presence of oxygen. Pyruvic acid is transported into the mitochondria where it is converted into acetyl CoA with the release of CO_2 . Acetyl CoA then enters the tricarboxylic acid pathway or Krebs' cycle operating in the matrix of the mitochondria. NADH + H+ and $FADH_2$ are generated in the Krebs' cycle. The energy in these molecules as well as that in the NADH+ H+ synthesized during glycolysis are used to synthesize ATP. This is accomplished through a system of electron carriers called electron transport system (ETS) located on the inner membrane of the mitochondria. The electrons, as they move through the system, release enough energy that are trapped to synthesize ATP. This is called oxidative phosphorylation. In this process O_2 is the ultimate acceptor of electrons and it gets reduced to water.

The respiratory pathway is an amphibolic pathway as it involves both anabolism and catabolism. The respiratory quotient depends upon the type of respiratory substance used during respiration.

Chapter 13: Plant Growth and Development

Growth is one of the most conspicuous events in any living organism. It is an irreversible increase expressed in parameters such as size, area, length, height, volume, cell number etc. It conspicuously involves increased protoplasmic material. In plants, meristems are the sites of growth. Root and shoot apical meristems sometimes along with intercalary meristem, contribute to the elongation growth of plant axes. Growth is indeterminate in higher plants. Following cell division in root and shoot apical meristem cells, the growth could be arithmetic or geometrical. Growth may not be and generally is not sustained at a high rate throughout the life of cell/ tissue/organ/organism. One can define three principle phases of growth – the lag, the log and the senescent phase. When a cell loses the capacity to divide, it leads to differentiation. Differentiation results in development of structures that is commensurate with the function the cells finally have to perform. General principles for differentiation for cell, tissues and organs are similar. A differentiated cell may dedifferentiate and then redifferentiate. Since differentiation in plants is open, the development could also be flexible, i.e., the development is the sum of growth and differentiation. Plant exhibit plasticity in development.

Plant growth and development are under the control of both intrinsic and extrinsic factors. Intercellular intrinsic factors are the chemical substances, called plant growth regulators (PGR). There are diverse groups of PGRs in plants, principally belonging to five groups: auxins, gibberellins, cytokinins, abscisic acid and ethylene. These PGRs are synthesized in various parts of the plant; they control different differentiation and developmental events. Any PGR has diverse physiological effects on plants. Diverse PGRs also manifest similar effects. PGRs may act synergistically or antagonistically. Plant growth and development is also affected by light, temperature, nutrition, oxygen status, gravity and such external factors.

UNIT V HUMAN PHYSIOLOGY

Chapter 14: Breathing and Exchange of Gases

The first step in respiration is breathing by which atmospheric air is taken in (inspiration) and the alveolar air is released out (expiration). Exchange of O_2 and CO_2 between deoxygenated blood and alveoli, transport of these gases throughout the body by blood, exchange of O_2 and CO_2 between the oxygenated blood and tissues and utilization of O_2 by the cells (cellular respiration) are the other steps involved.

Inspiration and expiration are carried out by creating pressure gradients between the atmosphere and the alveoli with the help of specialized muscles – intercostals and diaphragm. Volumes of air involved in these activities can be estimated with the help of spirometer and are of clinical significance.

Exchange of O_2 and CO_2 at the alveoli and tissues occur by diffusion. Rate of diffusion is dependent on the partial pressure gradients of O_2 (pO_2) and CO_2 (pCO_2), their solubility as well as the thickness of the diffusion surface. These factors in our body facilitate diffusion of O_2 from the alveoli to the deoxygenated blood as well as from the oxygenated blood to the tissues. The factors are favorable for the diffusion of CO_2 in the opposite direction, i.e., from tissues to alveoli.

Oxygen is transported mainly as oxyhemoglobin. In the alveoli where pO_2 is higher, O_2 gets bound to hemoglobin which is easily dissociated at the tissues where pO_2 is low and pCO_2 and H+ concentration is high. Nearly 70 per cent of carbon dioxide is transported as bicarbonate (HCO_3–) with the help of the enzyme carbonic anhydrase. 20-25 per cent of carbon dioxide is carried by hemoglobin as carbaminohemoglobin. In the tissues where pCO_2 is high, it gets bound to blood whereas in the alveoli where pCO_2 is low and pO_2 is high, it gets removed from the blood.

Respiratory rhythm is maintained by the respiratory center in the medulla region of brain. A pneumotaxic centre in the pons region of the brain and a chemo sensitive area in the medulla can alter respiratory mechanism.

Chapter 15: Body Fluids and Circulation

Vertebrates circulate blood, a fluid connective tissue, in their body, to transport essential substances to the cells and to carry waste substances from there. Another fluid, lymph (tissue fluid) is also used for the transport of certain substances.

Blood comprises of a fluid matrix, plasma and formed elements. Red blood cells (RBCs, erythrocytes), white blood cells (WBCs, leucocytes) and platelets (thrombocytes) constitute the formed elements. Blood of humans are grouped into A, B, AB and O systems based on the presence or absence of two surface antigens, A, B on the RBCs. Another blood grouping is also done based on the presence or absence of another antigen called Rhesus factor (Rh) on the surface of RBCs. The spaces between cells in the tissues contain a fluid derived from blood called tissue fluid. This fluid called lymph is almost similar to blood except for the protein content and the formed elements.

All vertebrates and a few invertebrates have a closed circulatory system. Our circulatory system consists of a muscular pumping organ, heart, a network of vessels and a fluid, blood. Heart has two atria and two ventricles. Cardiac musculature is auto-excitable. Sino-atrial node (SAN) generates the maximum number of action potentials per minute (70-75/min) and therefore, it sets the pace of the activities of the heart. Hence it is called the Pacemaker. The action potential causes the atria and then the ventricles to undergo contraction (systole) followed by their relaxation (diastole). The systole forces the blood to move from the atria to the ventricles and to the pulmonary artery and the aorta. The cardiac cycle is formed by sequential events in the heart which is cyclically repeated and is called the cardiac cycle. A healthy person shows 72 such cycles per minute. About 70 mL of blood is pumped out by each ventricle during a cardiac cycle and it is called the stroke or beat volume. Volume of blood pumped out by each ventricle of heart per minute is called the cardiac output and it is equal to the product of stroke volume and heart rate (approx 5 litres). The electrical activity of the heart can be recorded from the body surface by using electrocardiograph and the recording is called electrocardiogram (ECG) which is of clinical importance.

We have a complete double circulation, i.e., two circulatory pathways, namely, pulmonary and systemic are present. The pulmonary circulation starts by the pumping of deoxygenated blood by the right ventricle which is carried to the lungs where it is oxygenated and returned to the left atrium. The systemic circulation starts with the pumping of oxygenated blood by the left ventricle to the aorta which is carried to all the body tissues and the deoxygenated blood from there is collected by the veins and returned to the right atrium. Though the heart is autoexcitable, its functions can be moderated by neural and hormonal mechanisms.

Chapter 16: Excretory Products and their Elimination

Many nitrogen containing substances, ions, CO_2, water, etc., that accumulate in the body have to be eliminated. Nature of nitrogenous wastes formed and their excretion vary among animals, mainly depending on the habitat (availability of water). Ammonia, urea and uric acid are the major nitrogenous wastes excreted.

Protonephridia, nephridia, malpighian tubules, green glands and the kidneys are the common excretory organs in animals. They not only eliminate nitrogenous wastes but also help in the maintenance of ionic and acid-base balance of body fluids.

In humans, the excretory system consists of one pair of kidneys, a pair of ureters, a urinary bladder and a urethra. Each kidney has over a million tubular structures called nephrons. Nephron is the functional unit of kidney and has two portions – glomerulus and renal tubule. Glomerulus is a tuft of capillaries formed from afferent arterioles, fine branches of renal artery. The renal tubule starts with a double walled Bowman's capsule and is further differentiated into a proximal convoluted tubule (PCT), Henle's loop (HL) and distal convoluted tubule (DCT). The DCTs of many nephrons join to a common collecting duct many of which ultimately open into the renal pelvis through the medullary pyramids. The Bowman's capsule encloses the glomerulus to form Malpighian or renal corpuscle.

Urine formation involves three main processes, i.e., filtration, reabsorption and secretion. Filtration is a non-selective process performed by the glomerulus using the glomerular capillary blood pressure. About 1200 ml of blood is filtered by the glomerulus per minute to form 125 ml of filtrate in the Bowman's capsule per minute (GFR). JGA, a specialised portion of the nephrons, plays a significant role in the regulation of GFR. Nearly 99 per cent reabsorption of the filtrate takes place through different parts of the nephrons. PCT is the major site of reabsorption and selective secretion. HL primarily helps to maintain osmolar gradient (300 mOsmolL–1 -1200 mOsmolL–1) within the kidney interstitium. DCT and collecting duct allow extensive reabsorption of water and certain electrolytes, which help in osmoregulation: H+, K+ and NH3 could be secreted into the filtrate by the tubules to maintain the ionic balance and pH of body fluids.

A counter current mechanism operates between the two limbs of the loop of Henle and those of vasa recta (capillary parallel to Henle's loop). The filtrate gets concentrated as it moves down the descending limb but is diluted by the ascending limb. Electrolytes and urea are retained in the interstitium by this arrangement. DCT and collecting duct concentrate the filtrate about four times, i.e., from 300 mOsmolL–1 to 1200 mOsmolL–1, an excellent mechanism of conservation of water. Urine is stored in the urinary bladder till a voluntary signal from CNS carries out its release through urethra, i.e., micturition. Skin, lungs and liver also assist in excretion.

Chapter 17: Locomotion and Movement

Movement is an essential feature of all living beings. Protoplasmic streaming, ciliary movements, movements of fins, limbs, wings, etc., are some forms exhibited by animals. A voluntary movement which causes the animal to change its place, is called locomotion. Animals move generally in search of food, shelter, mate, breeding ground, better climate or to protect themselves.

The cells of the human body exhibit amoeboid, ciliary and muscular movements. Locomotion and many other movements require coordinated muscular activities. Three types of muscles are present in our body. Skeletal muscles are attached to skeletal elements. They appear striated and are voluntary in nature. Visceral muscles, present in the inner walls of visceral organs are nonstriated and involuntary. Cardiac muscles are the muscles of the heart. They are striated, branched and involuntary. Muscles possess excitability, contractility, extensibility and elasticity.

Muscle fibre is the anatomical unit of muscle. Each muscle fibre has many parallelly arranged myofibrils. Each myofibril contains many serially arranged units called sarcomere which are the functional units. Each sarcomere has a central 'A' band made of thick myosin filaments, and two half 'I' bands made of thin actin filaments on either side of it marked by 'Z' lines. Actin and myosin are polymerised proteins with contractility. The active sites for myosin on resting actin filament are masked by a protein-troponin. Myosin head contains ATPase and has ATP binding sites and active sites for actin. A motor neuron carries signal to the muscle fibre which generates an action potential in it. This causes the release of Ca++ from sarcoplasmic reticulum. Ca++ activates actin which binds to the myosin head to form a cross bridge. These cross bridges pull the actin filaments causing them to slide over the myosin filaments and thereby causing contraction. Ca++ are then returned to sarcoplasmic reticulum which inactivate the actin. Cross bridges are broken and the muscles relax.

Repeated stimulation of muscles leads to fatigue. Muscles are classified as Red and White fibres based primarily on the amount of red coloured myoglobin pigment in them.

Bones and cartilages constitute our skeletal system. The skeletal system is divisible into axial and appendicular. Skull, vertebral column, ribs and sternum constitute the axial skeleton. Limb bones and girdles form the appendicular skeleton. Three types of joints are formed between bones or between bone and cartilage – fibrous, cartilaginous and synovial. Synovial joints allow considerable movements and therefore, play a significant role in locomotion.

Chapter 18: Neural Control and Coordination

The neural system coordinates and integrates functions as well as metabolic and homeostatic activities of all the organs. Neurons, the functional units of neural system are excitable cells due to a differential concentration gradient of ions across the membrane. The electrical potential difference across the resting neural membrane is called the 'resting potential'. The nerve impulse is conducted along the axon membrane in the form of a wave of depolarisation and repolarisation. A synapse is formed by the membranes of a pre-synaptic neuron and a post-synaptic neuron which may or may not be separated by a gap called synaptic cleft. Chemicals involved in the transmission of impulses at chemical synapses are called neurotransmitters.

Human neural system consists of two parts: (i) central neural system (CNS) and (ii) the peripheral neural system. The CNS consists of the brain and spiral cord. The brain can be divided into three major parts : (i) forebrain, (ii) midbrain and (iii) hindbrain. The forebrain consists of cerebrum, thalamus and hypothalamus. The cerebrum is longitudinally divided into two halves that are connected by the corpus callosum. A very important part of the forebrain

called hypothalamus controls the body temperature, eating and drinking. Inner parts of cerebral hemispheres and a group of associated deep structures form a complex structure called limbic system which is concerned with olfaction, autonomic responses, regulation of sexual behavior, expression of emotional reactions, and motivation. The midbrain receives and integrates visual, tactile and auditory inputs. The hindbrain comprises pons, cerebellum and medulla. The cerebellum integrates information received from the semicircular canals of the ear and the auditory system. The medulla contains centres, which control respiration, cardiovascular reflexes, and gastric secretions. Pons consist of fiber tracts that interconnect different regions of the brain.

Chapter 19: Chemical Coordination and Integration

There are special chemicals which act as hormones and provide chemical coordination, integration and regulation in the human body. These hormones regulate metabolism, growth and development of our organs, the endocrine glands or certain cells. The endocrine system is composed of hypothalamus, pituitary and pineal, thyroid, adrenal, pancreas, parathyroid, thymus and gonads (testis and ovary). In addition to these, some other organs, e.g. gastrointestinal tract, kidney, heart etc., also produce hormones. The pituitary gland is divided into three major parts, which are called as pars distalis, pars intermedia and pars nervosa. Pars distalis produces six trophic hormones. Pars intermedia secretes only one hormone, while pars nervosa (neurohypophysis) secretes two hormones. The pituitary hormones regulate the growth and development of somatic tissues and activities of peripheral endocrine glands. Pineal gland secretes melatonin, which plays a very important role in the regulation of 24-hour (diurnal) rhythms of our body (e.g., rhythms of sleep and state of being awake, body temperature, etc.). The thyroid gland hormones play an important role in the regulation of the basal metabolic rate, development and maturation of the central neural system, erythropoiesis, metabolism of carbohydrates, proteins and fats, menstrual cycle. Another thyroid hormone, i.e., thyrocalcitonin regulates calcium levels in our blood by decreasing it. The parathyroid glands secrete parathyroid hormone (PTH) which increases the blood Ca^{2+} levels and plays a major role in calcium homeostasis. The thymus gland secretes thymosins which play a major role in the differentiation of T-lymphocytes, which provide cell-mediated immunity. In addition, thymosins also increase the production of antibodies to provide humoral immunity. The adrenal gland is composed of the centrally located adrenal medulla and the outer adrenal cortex. The adrenal medulla secretes epinephrine and norepinephrine. These hormones increase alertness, pupillary dilation, piloerection, sweating, heartbeat, strength of heart contraction, rate of respiration, glycogenolysis, lipolysis, proteolysis. The adrenal cortex secretes glucocorticoids and mineralocorticoids. Glucocorticoids stimulate gluconeogenesis, lipolysis, proteolysis, erythropoiesis, cardio-vascular system, blood pressure, and glomerular filtration rate and inhibit inflammatory reactions by suppressing the immune response. Mineralocorticoids regulate water and electrolyte contents of the body. The endocrine pancreas secretes glucagon and insulin. Glucagon stimulates glycogenolysis and gluconeogenesis resulting in hyperglycemia. Insulin stimulates cellular glucose uptake and utilization, and glycogenesis resulting in hypoglycemia. Insulin deficiency and/or insulin resistance result in a disease called diabetes mellitus.

The testis secretes androgens, which stimulate the development, maturation and functions of the male accessory sex organs, appearance of the male secondary sex characters, spermatogenesis, male sexual behaviour, anabolic pathways and erythropoiesis.

The ovary secretes estrogen and progesterone. Estrogen stimulates growth and development of female accessory sex organs and secondary sex characters. Progesterone plays a major role in the maintenance of pregnancy as well as in mammary gland development and lactation. The atrial wall of the heart produces atrial natriuretic factor which decreases the blood pressure. Kidney produces erythropoietin which stimulates erythropoiesis. The gastrointestinal tract secretes gastrin, secretin, cholecystokinin and gastric inhibitory peptide. These hormones regulate the secretion of digestive juices and help in digestion.

(Reference: NCERT Text Book Class XI)

Chapter wise assignments:

Chapter: 01, The Living World

I. Very Short Answer Type Questions: (1 - Mark)

1. What do you mean by an organism?
2. What do you mean by living organism?
3. Define Habitat.
4. What is Biodiversity?
5. What do you infer by Nomenclature?
6. Define Taxonomy.
7. Define Systematics.
8. What do you understand by Classification?
9. Define Taxon.
10. Define Category.

II. Short Answer Type Questions: (2 - Marks)

1. What is the need of Classification?
2. What is the difference between Taxonomy and Systematics?
3. Expand; ICBN and ICZN.
4. Write the scientific names of: Mango, Man, Housefly and Wheat correctly.

5. Write all the taxonomical categories in hierarchical order.

III. Short Answer Type Questions: (3 - Marks)

1. Who proposed Binomial Nomenclature? What are the different rules to write the scientific name of an organism under this nomenclature?

IV. Long Answer Type Questions: (5 - Marks)

1. Define: Kingdom, Phylum, Class, Order, Family, Genus, and Species with two examples of each.

Chapter: 02, Biological Classification

I. Very Short Answer Type Questions: (1 - Mark)

1. How Aristotle classify the plants and animals?
2. Who gave two kingdom system of classification?
3. Who gave five kingdom system of classification?
4. Name three domains of classification.
5. Name the only member of the kingdom Monera.
6. Name the bacteria also known as blue green algae.
7. Name two Cyanobacteria which can fix atmospheric Nitrogen.
8. Name the special cells in Cyanobacteria that can fix atmospheric Nitrogen.
9. Name the smallest living cell, lacks cell wall and live without oxygen.
10. Name the kingdom of single celled eukaryotes.

II. Short Answer Type Questions: (2 - Marks)

1. Name the five kingdoms of classification given by R.H. Whittaker.?
2. Write four categories of bacteria based upon their shapes.
3. Name four types of protists with two examples of each.
4. What is Diatomaceous Earth?
5. What do you mean by Red Tides? What is its effect on marine animals?
6. What do you mean by Lichens and Mycorrhiza?

III. Short Answer Type Questions: (3 - Marks)

1. What are the limitations of two kingdom system of classification?
2. What are archaebacteria? Name three types of archaebacteria on the basis of their habitats.
3. Write a note on reproduction in Fungi.
4. What are Lichens? Why Lichens are called environmental indicators?
5. What is the difference between Virus and Viroid?

III. Long Answer Type Questions: (5 - Marks)

1. Write a note on the economic importance of Bacteria/ Protista/ Fungi.

CHATPER: 03, PLANT KINGDOM

I. Very Short Answer Type Questions: (1 - Mark)

1. Who gave artificial system of classification of Plants?
2. What is bases of Cytotaxonomy ?
3. Give two examples of green algae which show oogamous type of syngamy.
4. The process of double fertilization is present in which group of plants?
5. What is double fertilization?
6. Give two classes of bryophtyes .
7. Name an important phycocolloid .
8. Which plant groups are included in embryophyta ?
9. Name the tallest gymnosperm and angiosperm.
10. Name a plant group in which adult sporophyte is dependent on gametophyte.

II. Short Answer Type Questions: (2 - Marks)

1. In which part of the ovule, triple fusion takes place and it leads to the formation of which tissue?
2. What are rhizoids? What is the function of rhizoids?
3. Why are Bryophytes called the amphibians of the plant kingdom?
4. What do you understand by the term (seed habit) used in pteridophytes? Explain.

III. Short Answer Type Questions: (3 - Marks)

1. Compare the features of different types of algae.
2. “Bryophtes are ecologically more important. Justify this statement.
3. Give two examples of plants with:
   a. Haplontic life cycle., b. Diplontic life cycle., c. Haplo – diplontic life cycle.
4. Differentiate between algae and fungi.
5. Draw a schematic diagram to describe the haplo – diplontic life cycle pattern of a plant group .

III. Long Answer Type Questions: (5 - Marks)

1. Explain how sexual reproduction in angiosperms takes place through double fertilization and triple fusion. Also draw a labelled diagram of embryo sac to explain the phenomena.
2. Describe the important features of pteridophytes.
3. Describe the similarities and differences in sexual reproduction of a moss and fern.

CHATPER: 04 ANIMAL KINGDOM

I. Very Short Answer Type Questions: (1 - Mark)

1. What is radial symmetry?
2. What are triploblastic animals?
3. Define notochord.
4. Give two examples of hermaphrodite animals.
5. Why ctenophora are known as comb jellies?
6. Name the largest animal kingdom and second largest animal kingdom.
7. Name the three subphyla of phylum chordate.
8. What is the function of air bladders in osteichythes?
9. What are poikilothermos animals?
10. Identify the phylum in which adults exhibit radial symmetry and larva exhibit bilateral symmetry.

II. Short Answer Type Questions: (2 - Marks)

1. What is metagenesis? Mention an example which exhibits this phenomenon.
2. Mention two modifications in reptiles required for terrestrial mode of life.
3. These has been an increase in the number of chambers in heart during evolution of vertebrates give the names of the class of vertebrates having two, three or four chambered heart.
4. Draw labeled diagram of Pseudocoelom.
5. Differentiate between Notochord and nerve cord.
6. Mention two similarities between Aves and mammals.
7. Name: (a) A cold blooded animal (b) A warm blooded animal.
8. Name the phyla which shows: a) metamerism, b) Canal System, c) Comb plates, d)Cnidoblasts
9. What are the peculiar features that you find in parasitic Platyhelminthes?

10. Write the diagnostic characters of the chordates.

III. Short Answer Type Questions: (3 - Marks)

1. What are the modifications that are observed in birds that help them fly?
2. Name the class which shows: Airbladder, Cartiligenous notochord, Mammary glands, Pneumatic bones, Dual habitat and Sucking circular mouth.
3. "Arthropods are a highly successful group of animals" Comment.
4. Give difference between cartilaginous and bony fishes.
5. Differentiate between frog and toad.

III. Long Answer Type Questions: (5 - Marks)

1. a)"All vertebrates are chordates but all chordates are not vertebrates". Justify the statement.
b) Mammals are most adapted among the vertebrates. Elaborate.
3. Which is the largest phylum of animal kingdom. Give its five salient features at least five examples.
4. Give the three characteristic features of the following citing one example of each:
Chondrichthyes (b) Osteichthyes (c) Urochordata (d) Cephalochordata

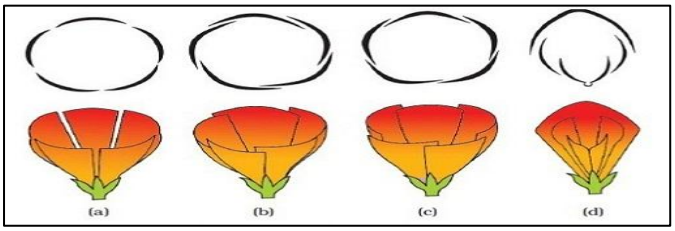
CHATPER: 05, MORPHOLOGY OF FLOWERING PLANTS

I. Very Short Answer Type Questions: (1 - Mark)

1. Name the roots that arise from any other plant part except the radical.
2. Reticulate venation is found in which type of plants?
3. Which part of ginger is edible?
4. What is the position of the ovary in an epigenous flower?
5. In Opuntia stem is modified into a flattened green structure to perform the function of leaves. What is its name?
6. What term is given to the arrangement of leaves on the stem?
7. Name a plant in which leaves are pinnately compound.
8. Give an example of false fruit.
9. In swampy areas plants bear a special type of roots. Name of those roots.
10. In potatoes, which part of the plant is modified for food storage?

II. Short Answer Type Questions: (2 - Marks

1. . What type of modifications of roots is found in the:(a) Banyan tree (b) Mangrove tree
2.. Underground parts of a plant are not always roots. Justify the statement.
3.. Define the terms: (a) Actinomorphic Flower (b) Zygomorphic Flower
4. Write the types of corolla aestivation with one example in the following flowers?



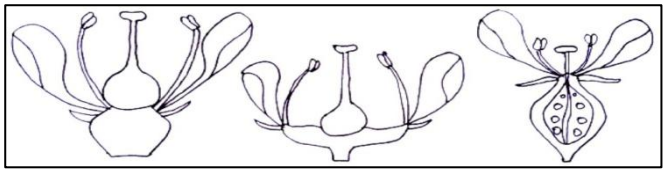
III. Short Answer Type Questions: (3 - Marks)

1. Differentiate between Racemose inflorescence and Cymose inflorescence.
2. Differentiate between Apocarpous and Syncarpous ovary.
3. Draw a well labelled diagram of V.S. of maize seed.
4. Draw Floral formula and Floral diagram of family Fabaceae.
5. Differentiate between Phylloclade and Cladode.

III. Long Answer Type Questions: (5 - Marks)

1. Describe various types of placentation found in Angiosperm plants.
2. Take one flower of the family Solanaceae. Write its semi technical term, also draw its floral formula and floral diagram .

3.Recognise following diagrams on the basis of position of ovary and describe with one example each.



4. Explain various regions of roots with suitable diagram.

CHATPER: 06, ANATOMY OF FLOWERING PLANT

I. Very short answer Type Questions: (1 - Mark)

1. Name the tissue represented by the jute fibres used for making the ropes.
2. Where is the product of photosynthesis stored?
3. Which kind of tools has polyarch vascular bundles?
4. What cells curl the leaves in plants during water stress?
5. What is heart wood?
6. Which forms the cambial ring in a dicot stem during the secondary growth?
7. What is a cambial ring comprised of?
8. State the role of pith in stem.
9. If a tree is debarked, what part of the plant is being removed?
10. Which meristem does produce growth in length?

II. Short Answer Type Questions: (2 - Marks)

1. What is the function of companion cells in phloem?
2. What are guard cells?
3. Why is cambium considered to be lateral meristem?
4. Give any four differences between tracheids and vessels.
5. How do open vascular bundles differ from closed vascular bundles?

III. Short Answer Type Questions: (3 - Marks)

1. What are trichomes? State their functions.
2. What is a stomatal apparatus? Draw a well labelled diagram of stomata.
3. Draw a well labelled diagram of T.S. of monocot stem.
4. What is the classification of angiosperms?
5. Difference between Dicot Root and Monocot Root?

III. Long Answer Type Questions: (5 - Marks)

1. Give five differences between Xylem and Phloem.
2. Give five differences between Dicot stem and Monocot stem.

CHATPER: 07, STRUCTURAL ORGANISATION IN ANIMALS

I. Very short answer Type Questions: (1 - Mark)

1. Name the process of which a tadpole develops into adult frog.
2. What does the term 'Amphibians' mean?
3.Name the sex of a frog in which sound producing vocal sacs are present.
4. Name the special venous connection between liver and intestine; and between kidney and intestine in frog.

II. Short Answer Type Questions: (2,3- Marks)

1. Give two identifying features of an adult male frog.
2. Mention two functions of ureter of frog.
3. Frog is beneficial for mankind. Justify the statement.
4. Difference between frog and toad.
5. Frog is poikilotherm, exhibits camouflage & undergoes aestivation and hibernation. How are these beneficial to it?

III. Long Answer Type Questions: (5 - Marks)

1. Draw a neat and well labelled diagram of male reproductive system of frog and explain.
2. Draw a neat diagram of digestive system of frog and explain.

CHATPER: 08, CELL: THE UNIT OF LIFE

I. Very short Answer Type Questions: (1 - Mark)

1. Which organelle is known as the powerhouse of the cell?
2. What is the main function of ribosomes?
3. Which organelle is called the 'suicidal bag' of the cell?
4. What is the structural and functional unit of life?
5. Which organelle is responsible for photosynthesis in plants?
6. Name the organelle responsible for detoxification in liver cells.
7. What is the name of the semi-fluid substance found inside the cell?
8. Who proposed the cell theory?
9. What is the primary function of the Golgi apparatus?
10. What is the cell wall in plant cells made of?

II. Short Answer Type Questions: (2-marks)

1.What is mesosome? Mention its functions.
2.What are the characteristics of a prokaryotic cell?
3. Where are these structures present: Cristae and Cisternae?
4. What are nuclear pores? State their function.

III. Short Answer Type Questions: (3-marks)

1. Compare the structure and components of prokaryotic and eukaryotic cells.
2. What is the endomembrane system? List its components and their functions
3. Explain the cell theory. Who proposed it, and what are its main postulates?

IV. Long answer type questions: (5 - Marks)

1. Describe the Fluid Mosaic Model of the plasma membrane. What are their keys components and functions?
2. Explain the structure and function of mitochondria. Why are they called the powerhouse of the cell?
3. Describe the role of ribosomes in protein synthesis. How do ribosomes differ in prokaryotic and eukaryotic cells?

CHATPER: 09, BIOMOLECULES

I. Very short Answer Type Questions: (1 - Mark)

1. What are biomolecules?
2. Which biomolecule is called the energy currency of the cell?
3. What is the monomer unit of proteins?
4. What is the storage form of glucose in animals?
5. Which bond joins two amino acids?
6. Name the sugar found in RNA and DNA.
7. What is the function of enzymes in biochemical reactions?

II.Short answer type questions: (3-Marks)

1. What are macromolecules? Give three examples.
2. Explain the composition of triglyceride.
3. Draw the structure of amino acids: Alanine, Glycine and Serine.

III. Long Answer Type Questions: (5 - Marks)

1. Explain the classification and nomenclature of enzymes.
2. On which factors does enzyme action depend. Explain

CHATPER: 10, CELL CYCLE AND CELL DIVISION

I. Very short answer Type Questions: (1 - Mark)

1. What is the process of nuclear division in somatic cells called?
2. What is the term for the division of the cytoplasm?
3. Which stage of mitosis is characterized by the alignment of chromosomes on the equatorial plate?
4. Name the phase of the cell cycle where DNA replication occurs.
5. What type of cell division occurs in gamete formation?
6. In which phase of meiosis does crossing over occur?

II. Short Answer Type Questions: (2 - Marks)

1. How do cells decide whether to divide, differentiate, or undergo apoptosis (programmed cell death)?
2. What molecular mechanisms allow a stem cell to decide its fate among various specialized cell types?
3. How do cells prioritize responses when faced with conflicting environmental signals?
4. What is the role of feedback loops in cellular decision-making processes?
5. How do cancer cells bypass normal cellular decision-making pathways?

III. Short Answer Type Questions: (3 - Marks)

1. What are the stages of mitosis, and how do they ensure the equal distribution of chromosomes?
2. How does meiosis contribute to genetic variation?

III. Long Answer Type Questions: (5 - Marks)

1. Describe Cell Cycle with the help of suitable diagrams.
2. Give comparative account between Mitosis and Meiosis.(10 points)

CHATPER: 11, PHOTOSYNTHESIS IN HIGHER PLANTS

I. Very short Answer Type Questions: (1 - Mark)

1. Which products formed during the light reactions of photosynthesis are used to derive the dark reactions?
2. What is the basis for designating the C_3 and C_4 pathways of photosynthesis?
3. In which form of the water plant absorb carbon through their general body surface?
4. What are the actual sites of the light reactions inside the chloroplasts?

. What are the actual sites of the dark reaction insides the chloroplasts?
5. Name the pigments which pickup nascent oxygen, released during photo oxidation of water, and change them into molecular state? Which pigment converted into vitamin A by animals and human beings?
6. Expand RUBISCO.
7. Which one is the most important limiting factor in photosynthesis?
8. Which cells in the plants have Rubisco?
9. Under what conditions are C_4 plants superior to C_3?
10. Name any two C_4 plants.

II. Short Answer Type Questions: (2, 3 - Marks)
1. By looking at which internal structure of plant can you tell whether a plant is C_3 or C_4? Explain
2. Rubisco is an enzyme that acts both as a carboxylase and oxygenase. Why do you think the rubisco carries out more carboxylation in C_4 plants?
3. Succulents are known to keep their stomata closed during the day to check transpiration. How do their meet these photosynthesis CO_2 requirements?
4. If a green plant is kept in dark with proper ventilation, can this plant carry out photosynthesis? Can anything be given as a supplement to maintain its growth or survival?

III. Long Answer Type Questions: (5 - Marks)
1. Differentiate between the following—
a) C_3 pathway and C_4 pathway
b) Non-cyclic phosphorylation and cyclic phosphorylation.
c) C_3 plants and C_4 plants
d) Photo system –I and photo system – II
2. Explain the C_3 cycle in detail.
3. Show diagrammatically non- cyclic and cyclic photophosphorylation.
4. Explain the C_4 cycle in detail.

CHATPER: 12, RESPIRATION IN PLANTS

I. Very short answer Type Questions: (1 - Mark)
1. What is the by-product of anaerobic respiration in plants?
2. Name the energy currency of all living cells.
3. Which cell organelle is known as power house of the cell?
4. Which enzyme is responsible for converting glucose into pyruvate during glycolysis?
5. In which part of the plant cell Krebs cycle takes place?
6. Name the enzyme that convert sucrose into glucose and fructose.
7. Name the cofactors required for the activity of pyruvate dehydrogenase.
8. Write RQ value for carbohydrates.
9. Write RQ value for fats.
10.Where is mitochondrial ETC is located?

II. Short answer Type Questions: (2 - Marks)
1. Define glycolysis.
2. What do you mean by fermentation?
3. Write equation for complete combustion of glucose.
4. What are respiratory substrates? Name the most common respiratory substrate.
5. Define respiration.

III. Short answer Type Questions: (3 - Marks)
1. Define RQ. What is its value for fats?
2. Distinguish between Aerobic and anaerobic respiration.
3. Show ATP synthesis in mitochondria diagrammatically.
4. Differentiate between glycolysis and citric acid cycle.
5. What is oxidative phosphorylation?

III. Long answer Type Questions: (5 - Marks)
1. Give schematic representation of glycolysis.
2. Explain Krebs' cycle in detail.

CHATPER: 13, PLANT GROWTH AND DEVELOPMENT

I. Very short Answer Type Questions: (1 - Mark)
1. What is growth?
2. Define differentiation.
3. What do you mean by the term Meristem?
4. Define growth rate.
5. Name the stress hormone in plants.
6. Which hormone is responsible for cell division?
7. Which PGR is involved in fruit ripening?
8. Name the process of conversion or a mature cell into a meristematic cell.
9. Name the gaseous PGR.
10.Which PGR promotes cell elongation?

II. Short Answer Type Questions: (2 - Marks)
1. Name two natural, synthetic auxins.
2. Define the term "callus".
3. Write three phases of growth.
4. Differentiate between growth and development.
5. Why ABA is called stress hormone?

III. Short Answer Type Questions: (3 - Marks)
1. Write a short note on the discovery of auxins.
2. What are the functions of ethylene hormone?
3. Explain sigmoid growth curve with the help of a diagram.
4. Describe the role of gibberellins in plant growth and development.

III. Long Answer Type Questions: (5 - Marks)
1. Explain how auxins are commercially used in agriculture and horticulture?
3. Describe the different phases of seed germination. Explain the role of water, oxygen and temperature

CHATPER: 14, BREATHING AND EXCHANGE OF GASES

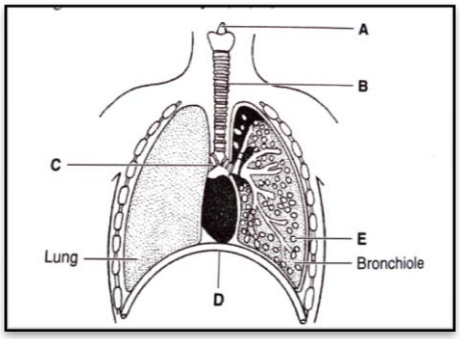
I. Very short answer Type Questions: (1 - Mark)
1 Name the primary site of exchange of gases in our body?
2. Cigarette smoking causes emphysema. Give reason.
3. What is the amount of O_2 supplied to tissues through every 100 mL of oxygenatedblood under normal physiological conditions?
4. Arrange the following terms based on their volumes in an ascending order:
(a)Tidal Volume (TV) (b) Residual Volume (RV) (c) Inspiratory Reserve Volume (IRV) (d) Expiratory Capacity (EC)
5. Name the important parts involved in creating a pressure gradient between lungs and the atmosphere during normal respiration.

II. Short Answer Type Questions: (2 - Marks)
1. State the different modes of CO_2 transport in blood.

2. Compared to O_2 diffusion rate of CO_2 through the diffusion membrane per unit difference in partial pressure is much higher. Explain.
3. For completion of respiration process, write the given steps in sequential manner:
(a) diffusion of gas (O_2 and CO_2) across alveolar membrane.
(b) Transport of gases by blood.
(c) Utilisation of O_2 by the cells for catabolic reactions and resultant release of CO_2.
(d) Pulmonary ventilation by which atmospheric air drawn in and CO_2 rich alveolar air is released out.
(e) Diffusion of O_2 and CO_2 between blood and tissues.
4. Define the following terms. (a) Tidal volume (b) Asthma.
5. A fluid filled double membranous layer surrounds the lungs. Name it and mention its important function .

III. Short Answer Type Questions: (3 - Marks)

1. What is Tidal volume? Find out the Tidal volume (approximate value) for a healthy human in an hour.
2. Diagrammatic view of human respiratory system is given below. Identify A, B,C,D and E:



III. Long Answer Type Questions: (5 - Marks)

1. Define various lung volumes and capacities that can be measured by spirometry.
2. Explain the transport of O_2 and CO_2 between alveoli and tissue with diagram.
3. Explain the mechanism of breathing with neat labeled sketches.

CHATPER: 15, BODY FLUIDS AND CIRCULATION

I. Very short answer Type Questions: (1 - Mark)

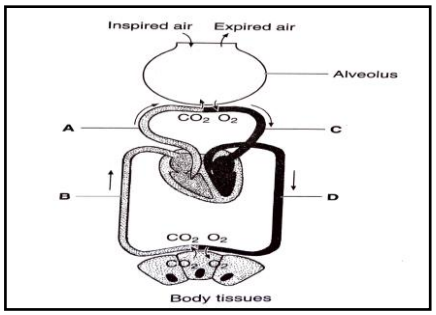
1. What is the average pH of the human blood?
2. What is hemopoiesis?
3. What is the life span of mammalian (human) RBCs?
4. What is polycythemia?
5. Name the enzyme which induces fibrin formation during blood coagulation.
6. What is the duration of cardiac cycle in a normal man?
7. What is the normal blood pressure of an adult man?
8. Name the blood component which is viscous and straw colored fluid.

II. Short Answer Type Questions: (2 - Marks)

1. Why do we call our heart myogenic?
2. Sino- atrial node is called the pacemaker of our heart. Why?
3. What is the function of anticoagulants? Name three anticoagulants.
4. What produces the first heart sound and the second heart sound?
5. Why is a person with O blood group considered to be a universal donor?

III. Short Answer Type Questions: (3 - Marks

1. What physiological circumstances lead to erythroblastosis fetalis?
2. The walls of ventricles are much thicker than atria. Explain.
3. Answer the following: (a) Name the major site where RBCs are formed.(b)which part of heart is responsible for initiating and maintaining its rhythmic activity?
4. What does the following diagram show? What does this diagram belong to our system. Identify A, B, C and D:



5. Draw the curve of ECG and label its peaks. What does these peaks show?

III. Long Answer Type Questions: (5 - Marks)

1. Define cardiac output and explain how it is calculated?
2. Describe the events in cardiac cycle. Explain " double circulation".
3. Explain different types of blood groups and donor compatibility by making a table

CHATPER: 16, EXCRETORY PRODUCTS AND THEIR ELIMINATION

I. Very short Answer Type Questions: (1 - Mark)

1. How ammonia is formed? Give the site of its formation?
2. What are podocytes?
3. What is GFR?
4. Define ultrafiltration.
5. What is dialysis?
6. Which two hormones help in osmoregulation?
7. Which is the nature of fluid which collects in the cavity of Bowman' capsule?
8. State one adaption of PCT for high degree of selective absorption.
9. Define selective absorption.
10. What is the site of counter current mechanism?

II. Short Answer Type Questions: (2 - Marks)

1. What is significance of efferent arteriole being narrow than afferent arteriole?
2. Give the normal constituents of urine.
3. What are the two modes of tubular reabsorption from nephrons?
4. Write four regions of nephron.
5. What is micturition? Give abnormal constituents of human urine.

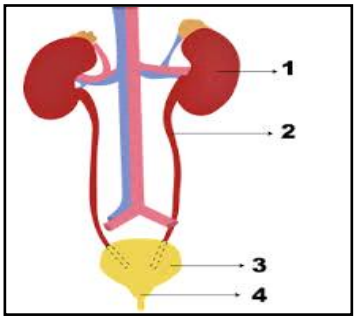
III. Short Answer Type Questions: (3 - Marks)

1. Describe the internal structure of human kidney.

2. Briefly explain the principle and function of haemodialysis.

III. Long Answer Type Questions: (5 - Marks)

1. Elaborate the counter current mechanism
2. Explain all the parts given in the diagram in detail.



CHATPER: 17, LOCOMOTION AND MOVEMENT

I. Very short answer Type Questions: (1 - Mark)

1. Name the oxygen storing pigment present in muscles.
2. Name the proteins present in A Band and I Band
3. State main cause of osteoporosis.
4. Name the smallest bone of human skeleton.
5. How many bones are present in human cranium?
6. Name the cavity in the girdle into which the head of femur fits.
7. Where is patella bone present?
8. What is the source of energy in muscular movement?
9. Which of the following is important for muscle contraction and nerve impulse transmission

a) Ca ion b) Ca ion and Mg ion c) Mg ion d) Fe ion

10. During vigorous exercise glucose is converted

a) Starch b) Glycogen c) Pyruvic acid d) Lactic acid

II. Short Answer Type Questions: (2 - Marks)

1. Differentiate striated and nonstriated muscles.
2. What is the role of Ca ions in muscles contraction?
3. Differentiate red and white skeletal muscles.
4. What is difference between bone and cartilage?
5. Give characters of cardiac muscles.
6. What is arthritis? How is it caused?

III. Short Answer Type Questions: (3 - Marks)

1. Write short note on synovial joints.
2. Give structure of contractile proteins.
3. Give list of number of bones in various parts of human skeleton.
4. Explain the sliding filament theory of muscle contraction.
5. Explain myofibril.

III. Long Answer Type Questions: (5 - Marks)

1. Explain the mechanism of muscle contraction.
2. What is a joint? Explain its various types with examples.
3. Explain structure of muscle fibre.

CHATPER: 18, NEURAL CONTROL AND COORDINATION

I. Very short Answer Type Questions: (1 - Mark)

1. Which part of the human brain is mostly developed?
2. Which part of our central nervous system acts as a master clock?
3. Name two types of matter of nervous system.
4. Which is the largest lobe of human brain?
5. State the functions of cerebellum.
6. Name the neurotransmitter released at the synapse by the sympathetic nerve fibres.
7. Give the significance of reflex actions.
8. Which part of human brain controls involuntary functions of body?
9. Give the potential difference in an unexcited and excited nerve fibre.
10. Difference between cerebrum and cerebellum.

II. Short Answer Type Questions: (2 - Marks)

1. Draw labelled diagram of neuron.
2. List the functions of cerebrum.
3. Define reflex actions. What is their significance?
4. Give the reason for unidirectional flow of nerve impulse from axon to dendron across a synapse.
5. Enlist four peculiar functions of human brain.

III. Short Answer Type Questions: (3 - Marks)

1. Explain the role of Na^+ in the generation of action potential.
2. Give the brief account of mechanism of synoptic transmission.
3. Match the following:

Column 1.	**Column 2**
T_4	Hypothalamus
PTH	Thyroid
GRH	Pituitary
LH	Parathyroid

4. Define: (i) Exocrine gland. (ii) Endocrine gland. (iii) Hormone
5. Difference between Myelinated and non-myelinated axons.

III. Long Answer Type Questions: (5 - Marks)

1. Write short note on the following:

a. Neural coordination
b. Synapse
c. Midbrain
d. Compare the following:
e. Central neural system and peripheral neural system.
f. Resting potential and action potential.

CHATPER:19, CHEMICAL COORDINATION AND INTEGRATION

I. Very short Answer Type Questions: (1 - Mark)

1. Which hormone was first discovered?
2. Why are TCT and PTH called antagonist hormones?
3. Why is pancreas called a heterocrine gland?
4. List two peculiar symptoms of diabetes mellitus.
5. Name two glycoprotein hormones.
6. Name the hormone secreted by corpus luteum.
7. Why are contraceptive pills called combined pills?
8. Name two glycoproteins hormones.
9. Name the endocrine part of testis.
10. Give main functions of progesterone.

II. Short Answer Type Questions: (2 - Marks)

1. List two functions of testosterone.
2. Distinguish between diabetes mellitus and diabetes insipidus.
3. Distinguish between vasopressin and oxytocin.
4. Which hormone is called degrowth hormone and why?
5. What are estrogens?

III. Short Answer Type Questions: (3 - Marks)

1. Name the hormones which control the following processes:
a. Differentiation of T- lymphocytes. b. Release of sugar from liver. c. Child birth.
2. Name the organs or cells which secretes Thyroxine and Adrenaline. State their functions.
3. Give the full form of FSH. Name the gland that secretes it. How does it differ in function in a male and a female?

III. Long Answer Type Questions: (5 - Marks)

1. Name the hormone that regulates each of the following function. Also mention the source of it.
   a. Urinary elimination of water
   b. Storage of glucose as glycogen
   c. Sodium and potassium ion metabolism
   d. Basal metabolic rate
   e. Descent of testis in scrotum
2. Write the functions of the following hormones:
a.Parathyroid hormone **b.**Thyroid hormone **c**.Thymosins **d**.Androgens **e**. Estrogens

SAMPLEPAPER-1

Time:3hrs **10+1 BIOLOGY** **MM:70**

Note:

1. **Question paper has four parts A, B,C and D.**
2. **Section A has 28 questions, having1markseach.15questionsare MCQ,7 questions are fill in the blanks and 6 are True/False.**
3. **Section B has10 questions having 2 marks each.**
4. **Section C has 4questions having 3 marks each.**
5. **Section D has 2 questions having 5 marks each. Both questions have internal choice.**

1.

Section-A (1mark each)

1. **A group of related genera represents**
   (a)Species(b) Taxa(c) Order(d) family
2. **An association between roots of higher plants and fungi is called**
   (a)Lichen(b)Fern(c)Mycorrhiza(d)Cyanobacteria
3. **Mannitol is the stored food in**
   (a)Chara (b)Fucus(c) Porphyra(d) Gracillaria
4. **Which of the following pairs of animals has non-glandular skin**
   (a)Snake& Frog(b) Frog& Pigeon
   (c)Chameleon& Turtle(d) Crocodile &Tiger
5. **The placenta is attached to the developing seed near the**
   (a)Testa(b)Hilum(c)Micropyle(d)Chalaza
6. **In annual ring, the light-colored part is known as**
   (a)Earlywood(b)Latewood(c) Heartwood(d) sap wood
7. **Which one of these is not a eukaryote**
   (a)Euglena(b)Anabaena(c)Spirogyra(d)Agaricus
8. **Which enzyme converts glucose into alcohol?**
   (a)Zymase(b)Diastase(c) Invertase(d)Lipase
9. **Spindle fibers are made up of**
   (a)Tubulin(b)Humulin(c)Flagellin(d)Intermediate filaments
10. **A hormone delaying senescence is**
    (a)Auxin(b)Cytokinin(c)Ethylene(d) Gibberellin
11. **How many teeth appear twice during the life span of individual?**
    (a)16(b)32(c)22(d)20
12. **When CO_2 concentration increases in blood, breathing becomes:**
    (a) Slow & deep (b) faster & deeper (c) Shallower & slow (d)No effect on breathing
13. **Excretory waste of birds and reptilesis:**
    (a)Urea (b) Uric acid (c) Urea & Uric acid (d) Ammonia & Uric acid
14. **Ribs attached to sternum are:**
    (a)First Seven pairs (b) All Ten pairs (c) First ten pairs (d)First five pairs
15. **Hormone responsible for ovulation is:**
    (a)LH(b) FSH (c)Progesterone(d)Testosterone
16. Leeuwenhoek was the first to observe the bacteria. T/F
17. Flatworms have true coelom. T/F
18. Blood platelets are formed from macrophages. T/F
19. Duplication of DNA is called Replication. T/F
20. Three molecules of ATP are synthesized during glycolysis.T/F
21. Left ventricle is the thickest chamber of the heart. T/F
22. The human shave ..... sense organs which help them to sense the environment.
23. **.....** egg is the largest eukaryotic cell.
24. **.....** Are called as suicidal bags of cell.
25. Abbreviation NPK means…….
26. pH value of human urine is……
27. We see color with..... cells of eye.
28. Deficiency of iodine leads to a disease called…….

Section – B (2 marks each)

2. Expand ICBN and ICZN.
3. How important is the presence of air bladder in Pisces?

OR

Differentiate between open circulatory system and closed circulatory system.

4. Write the functions of phellogen and phelloderm?

OR

Differentiate between heart wood and sap wood.

5. What are cellular components of blood?

6. Why mitosis is called equational division?

7. Differentiate between diffusion and osmosis.

8. Why is abscisic acid also known as stress hormone?

9. Why do we consider blood as a connective tissue?

11. What is joint? Discuss its types with examples.

Section – C (3 marks each)

12. Write a note on economic importance of algae.

13. Differentiate between monocot root and dicot root.

OR

How an annual ring is formed.

14. Draw a well labelled diagram of human cell.

15. What happens to the respiratory process in man going up a hill?

OR

Define the followings and give their values in a normal adult man:

(a)Tidal volume(b)Inspiratory capacity(c)Expiratory reserve volume

Section- D (5 marks each)

16. Differentiate between Mitosis and Meiosis giving 10 points..

OR

Explain the fluid mosaic model of plasma membrane.

17. Explain the major steps in Krebs cycle. Why is this cycle called as citric acid cycle?

OR

Write down six differences between glycolysis and Krebs cycle.

SAMPLE PAPER-2

10+1 BIOLOGY

Time: 3 Hours **M. M.: 70**

- **Note: Question paper has four parts A, B, C and D with a total of 17 questions.**
- **Section-A has question number 1 having 28 questions of 1 mark each. 15 questions are MCQ type, 7 fill in the blanks and 6 True/false.**
- **Section-B has question 2 to question 11-total 10 questions of 2 marks each**
- **Section-c has question 12 to question 15 –total 4 questions of 3 marks each**
- **Section-D has question 16 and question 17 total 2 questions of 5 marks each**

Section-A (1 mark each)

1.

Multiple Choice Questions:

1. Basic unit of taxonomy is:

A. Species. B. Variety. C. Genus D. Family

2. Four kingdom system classification was suggested by:

A. Haeckel. B. Linnaeus. C. Whittaker. D. Mendel

3. Red algae is also known as

A. Chlorophyceae B. Phaeophyceae C. Rhodophyceae. D. None of the above

4. Bioluminescence is the characteristic feature of

A. Protozoa. B. Annelida. C. Coelenterata. D. Mollusca

5. Arrangement of veins and veinlets on the Lamina of the leaf is called:

A. placentation. B. Aestivation C. Venation. D. Phyllotaxy

6. Phloem in gymnosperms lack:

(A) Sieve tubes only

(B) Companion cells only

(C) Phloem fibers

(D) Both sieve tube and companion cells

7. Which of the following is the simplest amino acid?

A. Glycine. B. Alanine C. Serine. D. Tyrosine

8. The product of aerobic respiration is

A. pyruvic acid. B. ethyl alcohol C. Malic acid D. Lactic acid

9. Function of Golgi apparatus is

A. Synthesis of protein B. Packaging of protein C. Synthesis of Lipid D. Formation of ATP

10. Which type of blood cells helps in clotting?

A. RBCs B. Platelets C. WBCs. D. Plasma

11. Gaseous plant growth regulator is

A. auxin. B. Gibberellins. C. Ethylene. D. ABA

12. Which organ produces urea as excretory product in humans

A. lungs B. Kidney C. Liver D. Heart

13. Pachytene is the substage of

A. Mitosis1. B. Mitosis 2. C. Meiosis 1. D. Meiosis 2

14. The cardiac muscle is present in

A. Heart. B. Chest. C. Lungs. D. Liver

15. The hormone which is responsible for milk secretion after parturition.

A. Insulin B. Prolactin. C. Glucagon. D. Thyroxine

Fill in the blanks (1 mark each)

15. _____is the scientific name of mango.

16. _____is a eukaryotic unicellular kingdom.

17. Photosynthesis occurs in the _____ of the plant cell.

18. _____is called the suicidal bag of the cell.

20 _____ is the excretory organ of humans.

21 .Centre for hunger is located in ____of the heart

22. Pancreas secretes _____hormone.

True / False

23. The SA node is called the pacemaker of the heart.

24. Plant cells lack a cell wall.

25. *Rana tigrina* is the scientific name of cockroach.

26. The largest unit of protein is called amino acids.

27.Glycolysis takes place in the nucleus.

28. The Largest phylum is Porifera**.**

Section – B (2 marks each)

2. Define taxon. Give one example

3. Write important characteristics features of phylum Porifera **OR** Amphibia

4. What are closed vascular bundles? Give one example

5. Which organelle is called the powerhouse of the cell and why?

6. What is the RQ value for proteins and fats?

7. Why is meiosis called reductional division?

8. Differentiate between actin and myosin filaments.

9. Write one function of cytokinins, ethylene and abscisic acid

10. Name the blood group which is universal donor and universal recipient.

11. Write the function of cerebrum and cerebellum.

OR

Draw the structure of a neuron.

Section – C (3 marks each)

12. Write about the characters of three different types of algae.

13. Explain different types of placentation in flowering plants?

OR.

Draw the digestive system of a frog.

14. Explain the double circulation in the human heart.

OR

Write the steps of the respiration involved in humans.

15. Write the steps of action of an enzyme.

Section - D (5 marks each)

16. Explain fluid mosaic model of plasma membrane.

OR

Difference between Mitosis and meiosis.

17. Give a schematic representation of the C_4 cycle.

OR

Explain Kreb's cycle.