GOA UNIVERSITY
Taleigao Plateau

SYLLABUS FOR GOA UNIVERSITY ADMISSIONS RANKING TEST (GU-ART) IN BIOCHEMISTRY

Diversity of Living Organisms:

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

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

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.

Biomolecules:

Chemical constituents of living cells; Carbohydrates - Classification (aldoses and ketoses), monosaccahrides (glucose and fructose), D-L configuration oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen); Importance of carbohydrates.

Proteins -Elementary idea of - amino acids, peptide bond, polypeptides, proteins, structure of proteins - primary, secondary, tertiary structure and quaternary structures (qualitative idea only), denaturation of proteins; enzymes. Hormones - Elementary idea excluding structure.

Fatty acids and lipids (glycerides, cholesterol).

Enzymes- types, properties, enzyme action. Effect of different temperatures and pH on the activity of salivary amylase on starch.

Nucleic Acids: DNA and RNA nucleic acids (nucelosides, nucleotides, nitrogenous bases). Isolation of DNA.

Vitamins: Classification and functions. Coenzymes - Definition, Coenzymes derived from vitamins - TPP (Thiamine), FMN, FAD (Riboflavin), Pyridoxal phosphate (Pyridoxine), cobamide coenzyme (Cyanocobalamine), NAD, NADP (Niacin), THFA (Folic acid), CoA (Pantothenic acid), Biotin.

Bioenergetics: ATP as a high energy system, Structure of ATP, Hydrolysis of ATP & other high energy phosphate compounds, Utilization of ATP energy in chemical work,

ATP cycle: The linkage of energy-yielding oxidation to energy-requiring biosynthetic reaction, ETC and Oxidative phosphorylation

Enzymes: Definition; protein nature, active site, specificity, Holoenzyme, Apoenzyme, Coenzyme, Cofactors, Prosthetic group, monomeric, oligomeric and allosteric enzymes. Classification and nomenclature of enzymes with examples.

Metabolism:

Concept of Metabolism: Anabolism, Catabolism; Energetics

Carbohydrates: Major pathways: EMP, HMP, TCA pathway (Amphibolic pathway, Anaplerotic reactions), Alcohol fermentation

Lipids: Beta and omega-oxidation

Proteins: Digestion of proteins and peptides; Flow sheet of amino acid oxidation, Transamination, Deamination, Decarboxylation

Cell Cycle and Cell Division: Cell cycle, mitosis, meiosis and their significance.

Human Physiology:

Digestion and Absorption: Alimentary canal and digestive glands, role of digestive enzymes and gastrointestinal hormones; Peristalsis, digestion, absorption and assimilation of proteins, carbohydrates and fats; calorific values of proteins, carbohydrates and fats

Breathing and Exchange of Gases: Respiratory system in humans

Body Fluids and Circulation: Composition of blood, blood groups, coagulation of blood; composition of lymph and its function;

Excretory Products and Their Elimination: Modes of excretion - ammonotelism, ureotelism, uricotelism; human excretory system – structure and function; urine formation, osmoregulation;

Genetics and Evolution:

Heredity and variation: Mendelian inheritance; deviations from Mendelism – incomplete dominance, co-dominance, multiple alleles and inheritance of blood groups, pleiotropy; elementary idea of polygenic inheritance; chromosome theory of inheritance; chromosomes and genes.

Molecular Basis of Inheritance: Search for genetic material and DNA as genetic material; Structure of DNA and RNA; DNA packaging; DNA replication; Central dogma; transcription, genetic code, translation; gene expression and regulation - lac operon; DNA fingerprinting.

Evolution: Origin of life; biological evolution; Darwin's contribution, modern synthetic theory of evolution; mechanism of evolution - variation (mutation and recombination) and natural selection with examples, types of natural selection.

Environmental Issues:

Air pollution and its control, suspended particulate matter in air; water pollution and its control; agrochemicals and their effects; solid waste management; radioactive waste management; greenhouse effect and climate change impact and mitigation; ozone layer depletion; deforestation.

Concepts of Chemistry: General Introduction: Importance and scope of chemistry. Nature of matter, laws of chemical combination, Dalton's atomic theory: concept of elements, atoms and molecules. Atomic and molecular masses, mole concept and molar mass, percentage composition, empirical and molecular formula, chemical reactions, stoichiometry and calculations based on stoichiometry.

Structure of Atom: Bohr's model and its limitations, concept of shells and subshells, dual nature of matter and light.

Classification of Elements and Periodicity in Properties: Modern periodic law and the present form of periodic table, periodic trends in properties of elements, electronegativity, valency. Nomenclature of elements with atomic number greater than 100.

Chemical Bonding and Molecular structure: Valence electrons, ionic bond, covalent bond, bond parameters, Lewis structure, polar character of covalent bond, covalent character of ionic bond, valence bond theory.

States of Matter: Gases, Liquids and Solids; Three states of matter, intermolecular interactions, types of bonding, melting and boiling points, role of gas laws in elucidating the concept of the molecule.

Liquid State: vapour pressure, viscosity and surface tension

Solid state: Classification of solids based on different binding forces: molecular, ionic, covalent and metallic solids, amorphous and crystalline solids.

Chemical Thermodynamics: Concepts of System and types of systems, surroundings, work, heat, energy, extensive and intensive properties, state functions. Laws of thermodynamics.

Equilibrium: Equilibrium in physical and chemical processes, Le Chatelier's principle, ionic equilibrium- ionization of acids and bases, strong and weak electrolytes, degree of ionization, ionization of poly basic acids, acid strength, concept of pH, Henderson Equation, hydrolysis of salts, buffer solution, solubility product, common ion effect.

Redox Reactions: Concept of oxidation and reduction, redox reactions, oxidation number, balancing redox reactions, in terms of loss and gain of electrons and change in oxidation number, applications of redox reactions.

Hydrogen: Position of hydrogen in periodic table, occurrence, isotopes, preparation, properties and uses of hydrogen, hydrides-ionic covalent and interstitial; physical and chemical properties of water, heavy water, hydrogen peroxide -preparation, reactions and structure and use; hydrogen as a fuel.

Hydrocarbons: Types (alkanes, alkenes, alkynes, aromatic), IUPAC nomenclature, Isomerism, physical and chemical properties

Environmental Chemistry: Environmental pollution - air, water and soil pollution, chemical reactions in atmosphere, smog, major atmospheric pollutants, acid rain, ozone and its reactions, effects of depletion of ozone layer, greenhouse effect and global warming- pollution due to industrial wastes, green chemistry as an alternative tool for reducing pollution, strategies for control of environmental pollution.

Analysis based on pH: pH of solutions, solution of known and varied concentrations of acids, bases and salts using pH paper or universal indicator; Comparison of the pH of solutions of strong and weak acids of same concentration.

Solid State: Classification of solids based on different binding forces: molecular, ionic, covalent and metallic solids, amorphous and crystalline solids (elementary idea).

Solutions: Types of solutions, expression of concentration of solutions of solids in liquids, solubility of gases in liquids, solid solutions, colligative properties - relative lowering of vapour pressure, Raoult's law, elevation of boiling point, depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties, abnormal molecular mass, Van't Hoff factor.

Electrochemistry: Redox reactions, conductance in electrolytic solutions, specific and molar conductivity, variations of conductivity with concentration, Kohlrausch's Law, electrolysis and law of electrolysis (elementary idea), dry cell-electrolytic cells and Galvanic cells, lead accumulator, EMF of a cell, standard electrode potential, Nernst equation and its application to chemical cells, Relation between Gibbs energy change and EMF of a cell, fuel cells, corrosion.

Chemical Kinetics: Rate of a reaction (Average and instantaneous), factors affecting rate of reaction: concentration, temperature, catalyst; order and molecularity of a reaction, rate law and specific rate constant, integrated rate equations and half-life (only for zero and first order reactions), concept of collision theory (elementary idea, no mathematical treatment). Activation energy, Arrhenious equation.

Surface Chemistry: Adsorption - physisorption and chemisorption, factors affecting adsorption of gases on solids, catalysis, homogenous and heterogenous activity and selectivity; enzyme catalysis colloidal state distinction between true solutions, colloids and suspension; lyophilic, lyophobic multi-molecular and macromolecular colloids; properties of colloids; Tyndall effect, Brownian movement, electrophoresis, coagulation, emulsion - types of emulsions.

Haloalkanes and Haloarenes: Nomenclature, nature of C-X bond, physical and chemical properties, mechanism of substitution reactions, optical rotation. Uses and environmental effects of - dichloromethane, trichloromethane, tetrachloromethane, iodoform, freons, DDT.

Alcohols, Phenols and Ethers: Nomenclature, physical and chemical properties

Aldehydes, Ketones and Carboxylic Acids: Nomenclature, nature of carbonyl group, physical and chemical properties

Amines: Nomenclature, classification, structure, physical and chemical properties

Polymers: Classification - natural and synthetic, methods of polymerization (addition and condensation), copolymerization, polythene, nylon polyesters, bakelite, rubber. Biodegradable and non-biodegradable polymers.

Chemistry in Everyday life: Chemicals in medicines - analgesics, tranquilizers antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines; Chemicals in food - preservatives, artificial sweetening agents, elementary idea of antioxidants. Cleansing agents - soaps and detergents, cleansing action.

Chromatography: Separation of pigments by paper chromatography and determination of Rf values; Separation of constituents present in an inorganic mixture containing cations.