

XL - Life Sciences GATE Exam Syllabus

GENERAL APTITUDE

Verbal Ability: English grammar, sentence completion, verbal analogies, word groups, instructions, critical reasoning and verbal deduction.

Numerical Ability: Numerical computation, numerical estimation, numerical

XL-H CHEMISTRY

Section 1: Atomic Structure and Periodicity

Planck's quantum theory, wave particle duality, uncertainty principle, quantum mechanical model of hydrogen atom, electronic configuration of atoms and ions. Periodic table and periodic properties: ionization energy, electron affinity, electronegativity and atomic size.

Section 2: Structure and Bonding

Ionic and covalent bonding, MO and VB approaches for diatomic molecules, VSEPR theory and shape of molecules, hybridization, resonance, dipole moment, structure parameters such as bond length, bond angle and bond energy, hydrogen bonding and van der Waals interactions. Ionic solids, ionic radii and lattice energy (Born-Haber cycle). HSAB principle.

Section 3: s, p and d Block Elements

Oxides, halides and hydrides of alkali, alkaline earth metals, B, Al, Si, N, P, and S. General characteristics of 3d elements. Coordination complexes: valence bond and crystal field theory, color, geometry, magnetic properties and isomerism.

Section 4: Chemical Equilibria

Colligative properties of solutions, ionic equilibria in solution, solubility product, common ion effect, hydrolysis of salts, pH, buffer and their applications. Equilibrium constants (K_c , K_p and K_x) for homogeneous reactions.

Section 5: Electrochemistry

Conductance, Kohlrausch law, cell potentials, emf, Nernst equation, Galvanic cells, thermodynamic aspects and their applications.

Section 6: Reaction Kinetics

Rate constant, order of reaction, molecularity, activation energy, zero, first and second order kinetics, catalysis and elementary enzyme reactions.

Section 7: Thermodynamics

First law, reversible and irreversible processes, internal energy, enthalpy, Kirchhoff equation, heat of reaction, Hess's law, heat of formation. Second law, entropy, free energy and work function. Gibbs-Helmholtz equation, Clausius-Clapeyron equation, free energy change, equilibrium constant and Trouton's rule. Third law of thermodynamics.

Section 8: Structure-Reactivity Correlations and Organic Reaction Mechanisms

Acids and bases, electronic and steric effects, optical and geometrical isomerism, tautomerism, conformers and concept of aromaticity. Elementary treatment of SN1, SN2, E1 and E2 reactions, Hoffmann and Saytzeff rules, addition reactions, Markownikoff rule and Kharash effect. Aromatic electrophilic substitutions, orientation effect as exemplified by various functional groups. Diels-Alder, Wittig and hydroboration reactions. Identification of functional groups by chemical tests.

XL-I BIOCHEMISTRY

Section 1:

Organization of life; Importance of water; Structure and function of biomolecules: Amino acids, Carbohydrates, Lipids, Proteins and Nucleic acids; Protein structure, folding and function: Myoglobin, Hemoglobin, Lysozyme, Ribonuclease A, Carboxypeptidase and Chymotrypsin.

Section 2:

Enzyme kinetics including its regulation and inhibition, Vitamins and Coenzymes ; Metabolism and bioenergetics; Generation and utilization of ATP; Metabolic pathways and their regulation: glycolysis, TCA cycle, pentose phosphate pathway, oxidative phosphorylation, gluconeogenesis, glycogen and fatty acid metabolism; Metabolism of Nitrogen containing compounds: nitrogen fixation, amino acids and nucleotides. Photosynthesis: Calvin cycle.

Section 3:

Biochemical separation techniques: ion exchange, size exclusion and affinity chromatography, Characterization of biomolecules by electrophoresis, UV-visible and fluorescence spectroscopy and Mass spectrometry.

Section 4:

Cell structure and organelles; Biological membranes; Transport across membranes; Signal transduction; Hormones and neurotransmitters.

Section 5:

DNA replication, transcription and translation; Biochemical regulation of gene expression; Recombinant DNA technology and applications: PCR, site directed mutagenesis and DNA-microarray.

Section 6:

Immune system: Active and passive immunity; Complement system; Antibody structure, function and diversity; Cells of the immune system: T, B and macrophages; T and B cell activation; Major histocompatibility complex; T cell receptor; Immunological techniques: Immunodiffusion, immunoelectrophoresis, RIA and ELISA.