

**MEDICAL UNIVERSITY OF PLOVDIV**  
**ADMISSION EXAMINATION FOR INTERNATIONAL STUDENTS**  
**CHEMISTRY SYLLABUS**

**GENERAL CHEMISTRY**

**1. Atomic structure.** Atomic number, atomic nucleus, atomic mass, isotopes and isobars. Electronic structure of the atom – energy levels, characteristics of s-, p- and-orbitals. Electronic configuration and orbital diagram of the elements of I and II period of the periodic table. Periodic trends – atomic radius, ionization energy, electronegativity, elements with metallic and nonmetallic character.

**2. Chemical bonding.** Ionic bond. Covalent bond – types (polar, nonpolar) and characteristics (bond energy and length, direction); coordinate (dative covalent) bonding. Metallic bond, hydrogen bond, Van der Waals forces.

**3. Rate of chemical reactions.** Kinetic equation, rate constant. Energy diagram of a reaction: activation energy, exothermic and endothermic reactions. Factors affecting rate of reaction – state of reactants, temperature, concentration, pressure. Rate determining step of a reaction. Catalysis – properties of catalysts. Mechanism of homogeneous and heterogeneous catalysis.

**4. Chemical equilibrium.** Reversible reactions, state of equilibrium. Equilibrium constant. Factors affecting chemical reactions in equilibrium. Effect of concentration and pressure change, effect of temperature and catalysts. Le Chatelier's principle.

**5. Solutions.** Types of solutions (saturated, supersaturated, unsaturated). Concentrations of solutions (mass and volume concentration, molar concentration, molality). Factors affecting the solubility of solid, liquid and gas compounds in liquids (nature of the solvent and solute, temperature, pressure). Properties of solutions that depend upon the concentration of solute (vapor pressure lowering, boiling point elevation, freezing point depression, and osmotic pressure).

**6. Electrolytes.** Weak and strong electrolytes, degree of dissociation. Theories of acids and bases (Arrhenius theory, Brønsted-Lowry theory, Lewis theory). Ionization of water – pH scale. Hydrolysis of salts.

**7. Oxidation-reduction reactions.** Basic concepts: oxidation number, oxidizing and reducing agents, oxidation and reduction, balancing oxidation-reduction reactions. Oxidizing and reducing properties of elements. Electrolysis – practical application.

## **INORGANIC CHEMISTRY**

**8. Properties of metals and nonmetals.** Reactivity series of metals, reactions with diluted acids, oxygen, nonmetals, water, acids and salts. Reactions of nonmetals with oxygen, hydrogen, other nonmetals, metals and salts.

**9. Chemical properties of basic and acid oxides, oxyacids and bases.** Reactions of oxides with water, other oxides, acids and bases. Reactions of oxyacids with metals, basic oxides, bases, and salts. Reactions of bases with oxides, acids, and salts.

**10. Amphoteric oxides and hydroxides.** Chemical properties.

## **ORGANIC CHEMISTRY**

**11. Basic concepts.** Hybridization of carbon atom. Sigma- and pi-bonds; single, double and triple bonds. Structural and stereoisomerism of organic compounds. General principles of IUPAC nomenclature for naming organic compounds.

**12. Hydrocarbons.** Homologous series of alkanes, alkenes, and alkynes. Alkane halogenation. Addition reactions of alkenes and alkynes. Polymerization of alkenes. Benzene and alkylbenzenes, substitution reactions with halogenes, nitric and sulphuric acid; Friedel – Craft reactions.

**13. Alcohols and phenols.** Classification and nomenclature of alcohols and phenols. Methods of preparation. Acid properties, ester formation, oxidation, dehydration.

**14. Carbonyl compounds.** Classification (aldehydes and ketones). Methods of preparation. Addition and condensation reactions of aldehydes and ketones. Oxidation of aldehydes.

**15. Carbohydrates.** Monosaccharides: structure, stereochemistry and chemical properties of glucose and fructose. Disaccharides: sucrose (structure and chemical properties). Polysaccharides: starch and cellulose – structure and biological functions.

**16. Carboxylic acids.** Preparation. Acid properties, formation of salts. Alpha halogenation, decarboxylation. Acid derivatives: halides, anhydrides, esters and amides – preparation and properties.

**17. Amines.** Classification, general methods of preparation (reduction of nitrogen containing compounds, from alkylhalides). Basic properties, formation of amides, reaction with nitrous acid.

**18. Amino acids.**  $\alpha$ -amino acids (glycine, alanine, phenylalanine, cysteine, aspartic acid, lysine) – structure (zwitterions) and stereoisomerism. Chemical properties of amino acids, formation of peptide bond.