

Admission Examination Topic

A. INORGANIC CHEMISTRY

Basic concepts in chemistry

Atom, molecule, ion, metal, non-metal, chemical symbols, writing and naming formulae of chemical substances and compounds, writing chemical equations.

Atomic structure

Atomic nucleus, mass number, chemical element, isotopes, atomic mass; Basic characteristics of the electron, principal energy levels (shells), sublevels (subshells), orbitals and quantum numbers. Electronic structure of an atom: aufbau ordering, Hund's rule and Pauli's principle. Electronic configuration and orbital diagram of the elements of I and II period of periodic system. Ground-state atom and excited-state atom.

Periodic Law and Periodic Table

Periodic law and structure of periodic table. Periodic properties of the elements. s-, p-, d-elements. Physical properties of the elements: atomic radii and electronegativity;

Chemical bonding

Lewis electron - dot structure. Covalent bond- definition, formation and types: σ - and π - bond, polar and non-polar, localized and delocalized, donor-acceptor bond, hybrid orbital model of s- and p- orbitals: sp^3 , sp^2 and sp - hybridization; covalent molecules- polar and non-polar. Ionic bond and compounds. Hydrogen bond. Valence and oxidation state.

Chemical elements

Chemical properties of elements. Reactions of metals with hydrogen, oxygen, non-metals, water, acids and salts. Reactions of non-metals with hydrogen, oxygen, other non-metals, metals and salts.

Chemical compounds

Chemical properties of basic, amphoteric and acidic oxides. Chemical properties and preparation of hydroxides and oxygen-containing acids. Salts - preparation and physical properties. Reaction of salts with metals and non-metals, acids and bases, other salts; decomposition of salts.

Oxidation-reduction reactions

Basic concepts and terms- oxidizing and reducing agent, oxidation and reduction, oxidation numbers. Balancing chemical equations. Redox reactions between electrolytes.

Thermochemistry

Basic terms in thermochemistry. Heat of reaction and thermo chemical equations. Hess' law. Activation energy and energetic diagram.

Chemical kinetics:

Reaction rate. Dependence of the reaction rate on concentration of reactants. Temperature dependence of reaction rates. Arrhenius equation.

Catalysis

Basic terms. Types of catalysis. Mechanism of heterogeneous and homogeneous catalytic action.

Chemical equilibrium

General description. Qualitative interpretation of the equilibrium constant (Equilibrium constant and Law of mass action). Le Chatelier's principle. Changing the reaction conditions-temperature, pressure and concentration;

Solutions

Composition of solutions. Solubility and saturated solutions. Electrolytic dissociation. Degree of dissociation – weak and strong electrolytes.

Acids and Bases

Acids, bases and salts according to the theory of electrolytic dissociation. Brønsted-Lowery concept for acids and bases - base pairs, strength of acids and bases. Ionization of water. Hydrogen exponent (pH).

B. ORGANIC CHEMISTRY

Basic terms in organic chemistry. Nomenclature of organic compounds

Names of organic compounds. Structure and isomerism of organic compounds. Functional groups.

Hydrocarbons. Alkanes Alkenes

Structure and isomerism. Nomenclature. Homologous series Physical and chemical properties. Methods for preparations

Aromatic Hydrocarbons (Arenes)

Benzene and its homologues series - structure, isomerism and nomenclature. Physical and chemical properties. Methods for preparation.

Alcohols and Phenols

Composition and structure. Nomenclature, classification and isomerism. Homologous series
Physical properties of some alcohols and phenols. Chemical properties of alcohols and phenols. Glycerol

Aldehydes and Ketones

Composition and structure. Nomenclature, classification. Homologous series. Chemical properties of aldehydes and ketones. Methods for preparation.

Carboxylic acids

Composition and structure. Nomenclature, classification and isomerism. Homologous series of carboxylic acids. Chemical properties of carboxylic acids. Methods for preparation.

Amines

Composition and structure. Nomenclature and classification. Physical and chemical properties of amines. Methods for preparation.

Amino Acids

Glycine, alanine, serine, phenylalanine and cysteine. Composition and naming. Structure, physical and chemical properties of α -amino acids. Peptide bond

Carbohydrates

Monosaccharide-composition and structure. Properties of glucose and fructose. Sucrose - composition and structure. Composition and structure of starch and cellulose.