

## **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:  $\sigma$ - and  $\pi$ - 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  $\alpha$ -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.