ENTRANCE EXAM PREPARATION TOPICS - CHEMISTRY

I THE STRUCTURE OF ATOMS, PERIODIC TABLE OF ELEMENTS

- The structure of the atom: the core, electron shell
- Regular and mass number
- Energy levels, sublevels, orbitals
- Quantum numbers
- Electronic configuration
- Periodic table of elements - periods, groups
- Periodic table of elements - metals, metalloids, non-metals and isotopes
- Periodical properties of elements
- Ionization energy
- Electron affinity
- Electronegativity

II CHEMICAL BONDS

- The electronic theory of valence
- Covalent bond - polar, non-polar, coordinative covalent bond
- Ionic bond
- Metallic bond
- Hydrogen bond

III ENERGY CHANGES IN CHEMICAL REACTIONS

- Enthalpy, entropy, Gibbs free energy
- combustion, thermal decomposition
- Exothermic and endothermic reactions

IV CHEMICAL KINETICS, CHEMICAL EQUILIBRIUM

- Chemical reaction speed and the factors which affect it
- Chemical equilibrium - constant balance, equilibrium concentrations
- Le Chatelier's principle and the factors that influence the change of chemical reactions balance

V SOLUTIONS

- Disperse systems - suspensions, emulsions, colloidal solutions, real solutions
- Solubility
- Quantitative expression of solution composition
- Quantity of substances, Avogadro's number, weight and quantity proportion, volume and mass concentration, molality, solution density

IV ELECTROLYTE SOLUTION

- Electrolytic dissociation - weak and strong electrolytes
- Degree of dissociation
- Dissociation constant
- Ionic reactions

VII BASIC TYPES OF INORGANIC COMPOUNDS

- Acids and bases - strong and weak
- Theories of acids and bases - Arrhenius, Brönsted-Lowry, Lewis

Amphoteric electrolytes

VIII IONIC PRODUCT OF WATER, pH and pOH
- Protolytic balance in water
- Ionic product of water
- pH and pOH

IX SALTS
- Acquiring and types of salts
- Neutralization
- Hydrolysis of salts

X BUFFER
- Buffer types and characteristics
- Mechanism of action
- Physiological buffer

XI SOLUTIONS' FEATURES
- Colligative properties of the solution
- Lowering freezing temperature, raising the boiling point, osmotic pressure
- Colloidal solutions - qualities, Faraday-Tyndall effect

XII OXIDO-REDUCTION
- Oxidation number
- Reduction and oxidation, reduction and oxidation agents
- Oxidation-reduction reactions equation
- Galvanic series of metals

XIII ELECTROCHEMISTRY
- Standard redox potential
- Chemical power sources
- Galvanic elements
- Electrolosis - solutions, melts

XIV TYPES OF INORGANIC COMPOUNDS
- Oxides - acidic, basic, amphoteric, neutral
- Oxides as acidic anhydrides
- Hydrides

XV FEATURES OF ELEMENTS AND THEIR COMPOUNDS
- Hydrogen and its compounds
- IA group elements, general properties, compounds of Na and K
- IIA group elements, general properties, compounds of Mg and Ca
- IIIA group elements, general properties, compounds of Al and B
- IVA group elements, general properties, compounds C, Si, Sn, and Pb
- VA group elements, general properties, compounds of n and P
- VIA group elements, general properties, compounds O and S
- VIIA group elements, general properties, compounds of F, Cl, Br and I

IB group elements, general properties, compounds of Cu and Ag
IIB group elements, general properties, compounds of Zn and Hg
Compounds of Cr, Mn, Fe, Co and Ni

XVI ISOMERY

Structural isomerism
Geometric isomerism (cis-trans)
Optical isomerism
Keto-enol isomerism
Tautomerism

XVII HYDROCARBONS

Alkanes (nomenclature, physical-chemical properties, reactions, important representatives)
Alkenes (nomenclature, physical-chemical properties, reactions, important representatives)
Alkynes (nomenclature, physical-chemical properties, reactions, important representatives)
Alkadienes (nomenclature, physical-chemical properties, reactions, important representatives)
Cyclanes (nomenclature, physical-chemical properties, reactions, important representatives)
Hybridization (sp^3, sp^2, sp)
Primary, secondary, tertiary, quaternary C atom
Nucleophilic and electrophilic reactions

XVIII AROMATIC HYDROCARBONS, HALOGENATED HYDROCARBONS

Benzene (physical-chemical properties, reactions)
Homologuous series and derivatives of benzene (nomenclature, physical-chemical properties, reactions)
Polycyclic arenes
Halogenated hydrocarbons (nomenclature, physical-chemical properties, reactions, important representatives)

XIX ALCOHOLS AND PHENOLS

Alcohols (nomenclature, classification, physical-chemical properties, reactions, representatives)
Polyhydroxy alcohols
Phenols (nomenclature, classification, physical-chemical properties, reactions, representatives)
Ethers (nomenclature, physical-chemical properties, reactions, important representatives)

XX ALDEHYDES AND KETONES

Aldehydes (nomenclature, classification, physical-chemical properties, reactions, significant representatives)
Ketones (nomenclature, classification, physical-chemical properties, reactions, important representatives)

XXI CARBOXYLIC ACID, SUBSTITUTED CARBOXYLIC ACID

Carboxylic acid (nomenclature, classification, physical-chemical properties, reactions, important representatives)
Substituted carboxylic acid (nomenclature, classification, physical-chemical properties, reactions, important representatives)

XXII CARBOXYLIC ACID DERIVATIVES

Acid derivatives:
Halides, anhydrides, esters, amides
Nomenclature, classification, physical-chemical properties, reactions, significant representatives

XXIII CARBONIC ACID DERIVATIVES, ORGANIC COMPOUNDS WITH SULFUR

Carbonic acid derivates:
phosgene, urea (carbamide), barbiturates, carbonates, etc.
Organic compounds with sulfur:
thiols, sulfides, sulfoxides, sulfonic acids, etc.

XXIV AMINES AND NITRO COMPOUNDS

Nomenclature, classification, physical-chemical properties, reactions, significant representatives

XXV AMINOACIDS

Nomenclature, classification, physical-chemical properties, reactions

XXVI PEPTIDES

Peptide bond - features
Peptides - nomenclature, physical and chemical properties, biologically important peptides
Proteins - structure, types, classification, properties, representatives

XXVII HETEROCYCLIC COMPOUNDS

Heterocyclic compounds with oxygen, nitrogen, sulfur
heterocyclic compounds with one or more heteroatoms
Five-membered, six membered and heterocyclic compounds and condensed rings
nomenclature, classification, representatives

XXVIII MONOSACCHARIDES

Nomenclature and Classification of monosaccharides
Physical-chemical properties of monosaccharides - isomerism, optical activity, reduction properties, etc.
Chemical reactions characteristic of monosaccharides
Monosaccharide representatives
Monosaccharide derivatives

XXIX DISACCHARIDES AND POLYSACCHARIDES

Glycosidic bond - formation, types
Representatives of disaccharides
Physical-chemical properties of disaccharides, disaccharide reaction
Polysaccharides - structure, links, physical-chemical properties, representatives

XXX LIPIDS

Fatty acids - nomenclature, classification, properties, reactions
Triacylglycerols (triglycerides) - physical-chemical properties, reactions