ENTRANCE EXAM PROGRAM: CHEMISTRY

Structure of Matter

Atomic Structure. Composition of Atomic Nuclei. Isotopes. Electron Distribution in Atoms. Chemical Element. Periodic Law and the Structure of the Periodic System. *s*-, *p* -, *d*-Elements. Relative Atomic Mass, Relative Molecular Mass. Mass Conservation Law. The mole is a unit of the quantity of a substance. Molar Mass. Avogadro's Law and its Consequences. Simple Substance, Complex Substance, Mixture of Substances. Concept of Allotropic Modifications. Types of Chemical Bonds. Formation of Covalent Polar and Nonpolar Bonds. Length and Binding Energy. Electronegativity of Chemical Elements. Formation of Ionic Bonds. Metallic Bond. Substances of Molecular and Non-Molecular Structure. Types of Crystal Lattices. Hydrogen Bond. Valence and Oxidation State.

Chemical Reaction

Physical and Chemical Phenomena. Classification of Reactions: Compounds, Decomposition, Substitution, and Exchange. Redox Reactions, Most Important Oxidizers and Reducing Agents. Electrolysis with Inert Electrodes of Molten Salts and Oxides; Salt Solutions. Reversibility of Reactions. Chemical Equilibrium and Conditions of its Displacement (Le Chatelier's Principle). Rate of Chemical Reactions and its Dependence on Various Factors. Rate Constant of Chemical Reactions. Catalysis. Thermal Effects of Chemical Reactions. Exothermic and Endothermic Reactions.

Solutions

Solubility of Substances, Dependence of Solubility of Substances on their Nature, Temperature and Pressure. Types of Solutions (Gaseous, Liquid, Solid). Expression of Solution Composition (Mass Fraction, Volume Fraction, Molar Concentration). Electrolytic Dissociation. Degree of Dissociation. Strong and Weak Electrolytes. Ionic Equations of Reactions. Idea of Colloidal Solutions. Importance of Solutions in Medicine and Biology, in Everyday Life.

Main Classes of Inorganic Compounds

Oxides, Acids, Bases, Salts (Classification, Nomenclature, Methods of Production and Properties). Ion Hydrolysis: Cation-based Hydrolysis (Salts of Aluminum, Iron, Chromium, Copper, Zinc, Ammonium, etc.); Anion-based Hydrolysis (Sulfites, Sulfides, Carbonates, Phosphates, Acetates, Silicates, etc.). COMPLETE HYDROLYSIS (FOR EXAMPLE, ALUMINUM SULFIDE). Amphotericity on the Example of Compounds of Beryllium, Zinc, Germany, Tin, Lead, Aluminum, Gallium, Indium, Chromium (III), Antimony (III), Vanadium (IV); Titanium (IV). Concepts on the Formation of Hydroxocomplexes.

Hydrogen and its Compounds

Hydrogen, its Physical Properties. Chemical Properties of Hydrogen: Interaction with Metals and Non-metals; Reduction of Metals from Oxides. Laboratory and Industrial Methods of Hydrogen Production. Hydrogen Applications. Water. Structure of Molecules. Physical and Chemical Properties (Interaction with Metals Under Different Conditions; Electrolysis; Formation of Crystallohydrates). Composition of Volatile Compounds of Hydrogen with Nonmetals (Diborane, Silane, Phosphine, Arsine, Hydrogen Selenide, Dellorologio). Idea of Hydrides. Interaction of Hydrides with Water.

Halogens and their Compounds

General Characteristics of the VIIA Group of the Periodic System. Chlorine, Molecular Structure, Physical and Chemical Properties (Reaction with Metals and Non-Metals; Water; Alkaline Solutions; Bromides and Iodides of the Metals, with other Complex Substances with Reducing Properties). Laboratory and Industrial Methods of Chlorine Production. Hydrogen Chloride, Molecular Structure. Physical Properties of Hydrogen Chloride. Chemical Properties of Hydrogen Chloride and its Aqueous Solution (Hydrochloric Acid): Interaction with Metals, Basic Oxides, Bases, Salts, Substances with Oxidizing Properties. Laboratory and Industrial Methods of Hydrogen Chloride Production. Comparison of Hydrogen Chloride with Hydrogen Fluoride, Hydrogen Bromide and Hydrogen Iodide. Qualitative Reactions to Halide Ions. Oxygen-containing Chlorine Compounds: Chlorine Oxides, Hypochlorous Acid and its Hypochlorite Salts; Chloric Acid and Chlorites; Chloric Acid and Chlorates, Perchloric Acid and Perchlorates.

Group VIA Elements

General Characteristics of the Group VIA of the Periodic Table.

Oxygen, its Physical Properties. Chemical Properties of Oxygen: Interaction with Metals and Non-Metals. Combustion. Laboratory and Industrial Methods of Oxygen Production. Comparison of the Physical and Chemical Properties of Oxygen and Ozone. Chemical Properties of Hydrogen Peroxide. Allotropic Modifications of Sulfur. Physical and Chemical Properties of Sulfur (Reactions with Metals; with Halogens, Oxygen, Phosphorus and Carbon; Relation to Acids; Disproportionation in Alkali Solution). Hydrogen Sulfide, its Physical Properties. Chemical Properties of Hydrogen Sulfide as a Weak Acid and Reducing Agent. Qualitative Reaction with Hydrogen Sulfide and Sulfide Ions. Obtaining Hydrogen Sulfide. Sulfur Oxide. Redox Duality of Sulfur Oxide (IV) and Sulfites. Sulfuric Acid, its Physical Properties. Chemical Properties of Sulfuric Acid as a Strong Acid and Oxidizer. Features of Interaction of Sulfuric Acid with Metals. Chemical Bases of Sulfuric Acid. Salts of Sulfuric Acid and their Properties. Qualitative

Reaction with Sulfate Ion. Concepts of Oxygen-Containing Compounds of Selenium And Tellurium.

VA Group Elements

General Characteristics of the VA Group of the Periodic System. Nitrogen, Molecular Structure, Physical Properties. Chemical Properties of Nitrogen: Interaction with Metals and Non-Metals. Ammonia. Structure of the Ammonia Molecule. Physical Properties of Ammonia. Chemical Properties of Ammonia as a Weak Base and Reducing Agent. Chemical Bases of Ammonia Production. Properties of Ammonium Salts (Reactions with Alkalis, Decomposition Reactions). Nitrides of Metals. Properties of Nitric (II) Oxide: Reaction with Oxygen. Properties of Nitric (IV) Oxide: Dissolution in Water in the Presence of Oxygen; Disproportion. Nitric Acid, its Physical Properties. Chemical Properties of Nitric Acid as a Strong Acid and Oxidizer, Decomposition of Nitric Acid. Features of Nitric Acid Interaction with Metals. Chemical Bases of Nitric Acid Production. Thermal Decomposition of Nitrates. Qualitative Reaction for the Nitrate Ion. Allotropic Modifications of Phosphorus. Physical and Chemical Properties of Phosphorus: Interaction with Metals and Non-Metals. Obtaining Phosphorus. Phosphorus(V) Oxide, its Physical Properties. Chemical Properties of Phosphorus Oxide(V): Interaction with Water, Bases and Basic Oxides, Water-Absorbing Properties. Phosphoric Acid (Metaphosphoric, Orthophosphoric, Diaspora), their Interconversions. Properties of Phosphoric Acid as a Weak Acid. Orthophosphate, Hydroorthophosphates, Orthophosphates, Hydroorthophosphates, Dihydrotrophosphates. Qualitative Reaction to Orthophosphate Ion. Concepts of Oxygen-Containing Compounds of Arsenic, Antimony and Bismuth.

Group IVA Elements

General Characteristics of Group IVA Elements of the Periodic System. Carbon, its Allotropic Modifications: Structure of Diamond and Graphite. Physical Properties of Diamond and Graphite. Chemical Properties of Carbon: Interaction of Simple Matter with Metals and Non-Metals, Reduction of Metals from their Oxides. Carbon Oxides, Molecular Structure, Physical Properties. Redox Duality of Carbon Monoxide (II): Reduction of Metals from their Oxides, Oxidation with Oxygen. Formation of Carbon Monoxide (II). Properties of the Carbon Oxide(IV): Reactions with Magnesium; Carbon; Calcium Hypochlorite. Properties of Carbonic Acid and its Salts. Interconversion of Carbonates and Hydrocarbonates. Decomposition of Bicarbonates and Insoluble Carbonates. Qualitative Reaction to Carbonate Ion. Hydrolysis of Calcium Carbide and Aluminum Carbide. Physical and Chemical Properties of Silicon, Silicon (IV) Oxide; Silicic Acid and Silicates. Natural Carbon and Silicon Compounds. Application of Carbon and Silicon Compounds.

General Characteristics of Metals

Position of Metals in the Periodic Table. Physical Properties of Metals. Alloys. General Methods for Producing Metals. Chemical Properties of Metals. Metal Electrochemical Series. Corrosion of Metals.

Properties of Group IA and Group IIA Metals

General Characteristics of Group IA and Group IIA of the Periodic System. Natural Compounds of Sodium and Potassium. Preparation of Sodium and Potassium. Chemical Properties of Alkali Metals: Reactions with Hydrogen, Oxygen, Halogens, Sulfur, Water. Preparation of Oxides and Hydroxides of Sodium and Potassium. Reaction of Sodium Peroxide with Carbon Dioxide. Application of Sodium and Potassium Compounds. Medical and Biological Importance of Sodium and Potassium Compounds. Natural Compounds of Magnesium and Calcium. Water Hardness and Methods of its Elimination. Chemical Properties of Beryllium, Magnesium and Alkaline Earth Metals: Reactions with Oxygen, Hydrogen, Nitrogen, Halogens, Sulfur, Water. Magnesium- and Calcium-based Reduction of Metals from their Oxides. Properties of Compounds of Group IIA Metals. Application of Magnesium and Calcium Compounds. Medical and Biological Significance of Magnesium and Calcium Compounds.

Properties of Aluminum

Natural Compounds of Aluminium. Properties of Simple Matter: Reactions with Oxygen, Halogens, Sulfur, Carbon, Alkalis and Acids. Properties of Aluminum Oxide and Hydroxide: Interaction with Acids and Alkalis. Formation of Aluminates by Fusion and Hydroxocomplex in the Aquatic Environment. Application of Aluminum and its Compounds.

Properties of Iron and some *d*-elements

Natural Iron Compounds. Properties of Simple Matter: Reactions with Oxygen, Halogens, Sulfur, Water Vapor; the Ratio of Iron to Dilute and Concentrated Acid Solutions. Rusting of Iron. Properties of Iron(II), (III) Oxides and Hydroxides in Comparison. Oxidation of Iron(II) Compounds by Oxygen, Hydrogen Peroxide and Other Oxidizing Agents. Qualitative Reactions with Fe^{2+} and Fe^{3+} Ions (with Potassium Hexacyanoferrates, Potassium Rodanide). Medical and Biological Significance of Iron Compounds. Concept of the Properties of Chromium, Copper, Zinc and their Compounds.

Introduction to Organic Chemistry

Provisions of the Theory of the Structure of Organic Compounds (A. Butlerov), its Development. Structural and Spatial Isomerism (Geometric and Optical). Homologous Series. Electronic Nature of Chemical Bonds in Molecules of Organic Compounds. Types of Hybridization of Electronic Orbitals of Carbon Atom: sp^3–; sp^2–; sp. Principles of Nomenclature of Organic Compounds. Mutual Influence of Atoms in Molecules of Organic Substances: Inductive and Mesomeric Effects. Type of Reaction: Substitution, Addition, Cleavage (Elimination), Isomerization.

Ideas about the Mechanisms of Reactions in Organic Chemistry. Homolytic and Heterolytic Covalent Bond Break. Free Radical and Ionic Reactions. Nucleophiles and Electrophiles.

Alkanes

Classification of Hydrocarbons. Natural Sources of Hydrocarbons. Homologous Series of Alkanes (Names of Alkanes and C_1–C_{10} Radicals; Isopropyl). General Formula of Alkanes. Electronic Structure of the Methane Molecule. Obtaining Alkanes: Hydrolysis of Aluminum Carbide, Wurtz Synthesis, Decarboxylation of Carboxylic Acid Salts, Hydrogenation of Alkenes. Physical Properties of Alkanes. Chemical Properties of Alkanes: Free Radical Substitution, Dehydrogenation, Dehydrocyclization (Aromatization), Cracking (Pyrolysis), Isomerization, Nitration. Mechanism of Radical Substitution Reactions on the Example of Methane and Propane. Alkane Oxidation: Formation of Peroxide Compounds, Catalytic Oxidation (Formation of Methanol and Formaldehyde from Methane), Combustion. Application of Alkanes. Methane Conversion.

Unsaturated Hydrocarbon

Homologous Series of Alkenes. General Formula of Alkenes. Electronic Structure of a Molecule of Ethylene: p-link; Double Link. Alkene Production Methods: Alcohol Dehydration; Halogenoalkane Dehydrohalogenation (Zaitsev's Rule); Dihaloalkane Dihalogenation; Alkane Dehydrogenation. Physical Properties of Alkenes. Chemical Properties of Alkenes: Addition of Halogens, Halides, Water (Hydration). Mechanism of Electrophilic Addition Reactions. Markovnikov's Rule. Addition of Hydrogen. Oxidation of Alkenes by Potassium Permanganate in Neutral Medium (Formation of Diols) and in Acidic Medium. Formation of Ethylene Oxide, its Interaction with Water. Polymerization. Polyethylene and Polypropylene. Homologous Series of Alkynes. Electronic Structure of Acetylene Molecule: Triple Bond. Physical Properties of Alkynes. Chemical Properties of Alkynes: Electrophilic Addition Reactions. Features of Hydration of Acetylene and its Homologues. Hydrogenation of Alkynes, Interaction of Alkynes with Bases (Ammonia Solution of Silver Oxide, Sodium Amide), Oxidation of Alkynes. Properties of Acetylene: Oxidation of Potassium Permanganate in a Neutral Medium; Dimerization and Trimerization. Alkyne Production Methods: Dehydrohalogenation of Dihalogenoalkanes; Dehydrogenation of Alkenes, Interaction of Acetylides with Halogenoalkanes. Acetylene Preparation from Methane and Calcium Carbide. Alkadienes. Types of Alkadienes (Conjugated, Isolated and Cumulated Double Bonds). Butadiene Production from Ethanol and Butane; Isoprene Production. Preparation of Alkadienes by the Dehydrohalogenation of Dihalogenoalkanes. Physical Properties of Alkadienes. Chemical Properties of Alkenes: 1,2– and 1,4– Addition; Polymerization. Natural and Synthetic Rubber. Application of Unsaturated Hydrocarbons.

Cyclic Hydrocarbons

Varieties of Carbocyclic Hydrocarbons: Saturated (Cycloalkane), Unsaturated (Cycloalkene and Cycloalkadiene), Aromatic (Arena). Structure of Cycloalkanes. Methods for Producing Cycloalkanes: Hydrogenation of Benzene, Dehalogenation of Dihalogen Derivatives, Pyrolysis of Salts of Dicarboxylic Acids. Chemical Properties of Small (C_3–C_4) Cycles: Addition of Hydrogen, Halogens, Halides; and Normal (C_5–C_6) Cycles: Free-radical Substitution Reactions: Halogenation, Nitration. Aromatic Hydrocarbons (Arenas). Electronic Structure of the Benzene Molecule. Condensed Aromatic Systems: Naphthalene, Anthracene, Phenanthrene. Benzene Homologues (Toluene, Xylenes, Ethylbenzene, Cumene). Physical Properties of Aromatic Hydrocarbons. Chemical Properties of Aromatic Hydrocarbons: Electrophilic Substitution Reactions (Halogenation, Nitration), Addition Reactions (Hydrogenation, Chlorination). Mechanism of Electrophilic Substitution Reactions. Orienting Effect of Substituents on the Benzene Ring: Orientats I (Alkyl, Halogen, $–NH_2$,–OH) and Type II ($−CF_3$, $–NO_2$, −CH=O, –COOH). Methods for Producing Benzene and its Homologues: Cycloalkane Dehydrogenation, Alkane Dehydrocyclization, Alkylation of Benzene with Alkenes and Halogenalkanes; Modification of Wurtz Synthesis, Acetylene Trimerization. Features of Reactions of Benzene Homologues: Substitution Reactions by Alkyl Substituent, Oxidation with Potassium Permanganate (Formation of Benzoic and Terephthalic Acids).

Alcohols and Ethers

Functional Group of Alcohols. Classification of Alcohols by Number of Hydroxyl Groups: Monatomic, Diatomic (Ethylene Glycol, etc.), Triatomic (Glycerin, etc.), Polyatomic (Sorbitol, etc.). Classification of Alcohols by Nature of Hydrocarbon Radicals: Limit (Homologous Series of Methanol), Unsaturated (Allyl Alcohol, etc.), Aromatic (Benzyl Alcohol, etc.). Concepts of Enols and Keto-Enol Tautomerism. Primary, Secondary and Tertiary Alcohols. Electronic Structure of Alcohol Molecules. Formation of Hydrogen Bond. Physical Properties of Alcohols. Methods for Producing Alcohols: Halogenoalkane Hydrolysis, Hydration of Alkenes, Reduction of Aldehydes and Ketones, Oxidation of Alkenes (Formation of Glycols), Fermentation of Glucose and from Halogenoalkanes. Ethanol Production by Glucose Fermentation. Methanol Production from Carbon Dioxide and Hydrogen. Chemical Properties of Alcohols. Acidic Properties of Alcohols: Interaction with Alkaline Metals; Hydrolysis of Alkoxides. Nucleophilic Substitution: Interaction with Hydrogen Halides (Mechanism of Reaction). Intramolecular and Intermolecular Dehydration. Formation of Esters with Organic and Inorganic Acids. Hydrogenation of Alcohols. Comparison of the Action of Oxidizing Agents on Primary, Secondary and Tertiary Alcohols. Ethanol (Butadiene) Dehydration-Dehydrogenation Reaction . Features of Chemical Properties of Polyatomic Alcohols (Ethylene Glycol, Glycerin): Complexation (with

Copper(II) Hydroxide; Formation of Glycerin Trinitrate. Application of Alcohols. Structure of Ethers. Production of Simple Esters: Intermolecular Dehydration of Alcohols, Interaction of Alkoxides with Halogenoalkane.

Phenols

Structure of Monoatomic (Phenol, Cresol) and Polyatomic (Pyrocatechin, Resorcinol, Hydroquinone, Pyrogallol) Phenols. Electronic Structure of the Phenol Molecule. Phenol Preparation (from Chlorobenzene). Physical Properties of Phenol. Chemical Properties of Phenol. Acidic Properties of Phenol: Interaction with Alkali Metals and Alkalis; Interaction of Phenolates with Acids, with Carbon Dioxide in One Solution. Electrophilic Substitution Reactions: Bromination and Nitration. Hydrogenation of the Aromatic Ring. Polycondensation of Phenol with Aldehydes. Qualitative Reaction of Phenols with Iron (III) Chloride.

Aldehydes and Ketones

Electronic Structure of Carbonyl Group. Homologous Series of Aldehydes and Ketones. Benzaldehyde. Methods for Producing Aldehydes: Oxidation (Dehydrogenation) of Primary Alcohols, Hydration of Acetylene, Catalytic Oxidation of Ethylene. Methods for Producing Ketones: Oxidation (Dehydrogenation) of Secondary Alcohols, Hydration of Acetylene Homologues, Pyrolysis of Calcium Salts of Carboxylic Acids. Physical Properties of Aldehydes and Ketones. Chemical Properties of Aldehydes: Reduction to Alcohols, Oxidation to Acids or Acid Salts: Silver Mirror Reaction, with Copper (II) Hydroxide when Heated. Halogenation of Aldehydes and Ketones. Mechanism of Nucleophilic Addition Reactions: Connection of Water, Hydrocyanic Acid, Sodium Hydrosulfite, Magnesium Organic Compounds. Use of Aldehydes and Ketones.

Carboxylic Acids and their Functional Derivatives

Electronic Structure of Carboxyl Group. Structure of Carboxylic Acids: Homologous Series of Formic Acid (Trivial Names of C_1-C_7 Acids); Dibasic Acids (Oxalic, Malonic, Succinic), Acrylic, Methacrylic, Croton, Vinylacetic, Citric, Lactic, Gluconic, Benzoic, Terephthalic, Salicylic, Acetylsalicylic Acids. Physical Properties of the Most Important Acids. Chemical Properties of Carboxylic Acids on the Example of Acetic Acid. Common Reactions Characteristic of Acids: With Metals, Basic Oxides, Bases, Salts of Weaker Acids. Mechanism of Esterification Reaction. Reactions of Carboxylic Acids with Phosphorus(III) Chloride and Thionyl Chloride. Methods for Producing Carboxylic Acids: Oxidation of Primary Alcohols and Aldehydes, Hydrolysis of Carboxylic Acid Derivatives, Interaction of Carbon (IV) Monoxide with Magnesium Organic Compounds, Oxidation of Benzene Homologues (for Aromatic Acids). Preparation of Formic Acid by Interaction of Carbon Monoxide (Ii) with Sodium Hydroxide and

Subsequent Treatment with Sulfuric Acid. Production of Acetic Acid by the Interaction of Methanol with Carbon Monoxide (II). Reaction of Acids with Hydrocarbon Radicals: Connection for Unsaturated Acids; Substitution for Saturated Acids (Formation of Chlorinated Carboxylic Acids). Structure of Functional Derivatives of Carboxylic Acids: Anhydrides, Chlorides, Amides, Esters. Nomenclature of Esters (Names of Acid Residues: Formate, Acetate, Propionate). Hydrolysis of Esters. Preparation of Anhydrides by Interaction of Carboxylic Acid Salts with Chlorides, Preparation of Esters by Interaction of Alcohols with Chlorides and Anhydrides. Preparation of Amides and Nitriles by the Action of Ammonia on Carboxylic Acids, followed by Hydration. Hydrolysis of Nitriles. Application of Carboxylic Acids, their Salts and Esters.

Fats

Structure of Fats. Acids, Residues of which are Part of Fats: Palmitic, Stearic, Oleic, Linoleic, Linolenic. Physical Properties of Fats. Alkaline and Acid Hydrolysis of Fats. Hydrogenation of Fats Containing Unsaturated Acid Residues. Transformation of Fats in the Body. Application of Fats. Synthetic Detergents.

Carbohydrates

Structure of Monosaccharides (Glucose, Fructose, Galactose, Ribose, Deoxyribose). Linear and Cyclic (α- and –β) Forms of Glucose. Physical and Chemical Properties of Glucose: Oxidation [Silver Mirror Reaction, with Copper (II) Hydroxide when Heated], Reduction, Formation of a Complex Compound with Copper (II) Hydroxide. Fermentation Reactions: Alcohol, Lactic Acid, Butyric Acid. Structure of Disaccharides (Sucrose, Maltose, Lactose). Hydrolysis of Disaccharides. Synthesis of Glucose and Starch in Plants. Transformation of Carbohydrates in the Body. Application of Carbohydrates. Structure of Amylose and Amylopectin (Starch), Dextrins, Cellulose. Chemical Properties of Polysaccharides: Hydrolysis; Formation of Cellulose Esters (Acetates, Nitrates). Qualitative Reaction for Starch with Iodine.

Amines

Structure of Amines. Classification of Amines: Primary, Secondary and Tertiary; Aliphatic and Aromatic. Quaternary Ammonium Salts. Physical Properties of Amines. Chemical Properties of Amines: Basicity of Amines (Reactions with Acids; with Salts of Metals Forming Insoluble Hydroxides). Dependence of Basicity of Amines on their Structures. Interaction of Amine Salts with Alkalis. Nucleophilic Substitution Reactions: Interaction of Amines with Esters, Chlorides, Anhydrides (Formation of Amides). Features of Chemical Properties of Aniline (Reaction with Bromine Water). Combustion of Amines. Methods for Producing Amines: Interaction Halogenoalkanes with Ammonia (Primary Amines) Amines Or

(Secondary, Tertiary Amines and Cations Tetraalkylammonium); Reduction of Nitro Compounds (Primary Amines).

Application of Amines.

Amino Acid. Proteins

Amino Acid. General Formula of Amino Acids. Nomenclature, Isomerism of Amino Acids (α-, β-, γ-Amino Acids). Structure of Amino Acids: Glycine, Alanine, Valine, Glutamic Acid, Lysine, Serine, Cysteine, Phenylalanine, Tyrosine. Optical Isomerism by the Example of Alanine. Methods for Producing Amino Acids: Interaction of α-Chlorocarboxylic Acids with Ammonia; Hydrolysis of Proteins. Amphoteric Properties of Amino Acids: Interaction with Acids and Bases, Formation of Internal Salt. Dependence of Amino Acid Ionization on Medium Nature. Formation of Peptides. Peptide (Amide) Bond. Proteins as High-Molecular Substances. Primary, Secondary and Tertiary Structure of Proteins. Globular and Fibrillar Proteins. Hydrolysis and Denaturation of Proteins (Reversible and Irreversible). Color Reactions of Proteins: Xanthoprotein, Biuretic, with Lead Acetate. Role of Proteins in Life.

Heterocyclic Compounds. Nucleic Acid

Structure of Pyridine and Pyrrole (Aroma). Physical Properties of Pyridine and Pyrrole. Chemical Properties of Pyridine: Basic Properties, Nitration, Hydrogenation (Formation of Piperidine). Comparison of Acid-Base Properties of Pyrrole with the Properties of Pyridine. Formation of Pyrrole-Potassium. Structure of Pyrimidine and Purine. Structure of Nucleic Bases (Cytosine, Uracil, Thymine, Adenine, Guanine). Tautomerism of Nucleic Acid Bases. Structure of Nucleotides. Polynucleotides: Structure of DNA and RNA, Principle of Complementarity. Role of Polynucleotides in Life.

Synthetic High-Molecular Substances

Basic Concepts of Macromolecular Chemistry: Monomer, Structural Link, Degree of Polymerization, Average Relative Molecular Weight. Polymerization and Copolymerization Reactions; Polycondensation (Homopolycondensation and Copolycondensation). Structure of the Most Important Polymers: Polyethylene, Polypropylene, Phenol-Formaldehyde Resin, Polyvinyl Chloride, Teflon, Polystyrene, Polymethyl Methacrylate, Polyvinyl Acetate. Natural Rubber. Synthetic Rubber: Butadiene, Divinyl, Styrene Butadiene, Chloroprene. Synthetic Fiber: Dacron, Nylon, Nylon 6, Acetate Fiber.