

**THE CONTENT OF THE EDUCATIONAL PROGRAM IN THE DISCIPLINE
«CHEMISTRY»
IN ENGLISH**

Part 1. Main conceptions and laws of chemistry

The subject and aims of chemistry. Physical and chemical processes. Mixtures and compounds. Atoms and molecules. Relative atomic and molecular mass. Mole as an amount of quantity of matter. Molar mass.

Chemical element, pure chemical element, compound. Chemical symbols and formulas. Stoichiometry. The law of the conservation of mass. Valence. Structural formulas. Mass percentage of the given element in the compound. Chemical equations. Avogadro's law. Molar volume of gases. Relative density of a gas per dry air.

Part 2. The Periodic table and the structure of atom

The Periodic table of chemical elements created by D. I. Mendeleev. Structure of the Periodic table. Dependences of certain features of chemical elements from their position in the Periodic table.

Structure of atomic nuclei and electron configurations for atoms from first four periods of the Periodic table. Isotopes. The Periodic table and the structure of atom.

Part 3. Chemical bonds and structure of matter

Types of chemical bonds: covalent (nonpolar and polar), ionic, hydrogen and metallic bonds. Examples of compounds with different types of bonds. Valence and oxidation state.

Classification of chemical reactions: combination, decomposition, single and double substitution reactions. Thermal effects of chemical reactions. Reduction-oxidation reactions and their balancing.

Part 4. Chemical kinetics and catalysis

The rate of chemical reaction. Dependence of the rate of chemical reaction on the nature of reactants, concentration and temperature. The concept of chemical equilibrium.

Part 5. Main types of inorganic compounds

Oxides, their classification and nomenclature, physical and chemical properties. Production of oxides.

Bases, their classification and nomenclature, physical and chemical properties. Alkalis. Production of bases.

Acids, their classification and nomenclature, physical and chemical properties. Production of acids.

Salts, their classification and nomenclature, physical and chemical properties. Production of salts.

Chains of chemical reactions between main types of chemical compounds.

Part 6. Solutions. Electrolytic dissociation

Solutions. Solubility of substances. Dependence of solubility on the nature of substance, temperature and pressure. Thermal effects of solution formation.

Hydrates of salts. Quantitative description of solution content. Molarity. Mass percentage of solute in solution.

Electrolytic dissociation. Dissociation degree. Strong and weak electrolytes. Ionic equations. Electrolytic dissociation of acids, bases and salts. Hydrolysis of salts.

Part 7. Chemistry of elements

Hydrogen, its physical and chemical properties, production and applications. Water. The structure of water molecule. Physical and chemical properties of water.

Properties of halogens. Chlorine, its physical and chemical properties. Hydrogen chloride. Hydrochloric acid and its salts. Test reaction for chloride anion.

Properties of elements from VIA group. Oxygen, its physical and chemical properties. Allotropy. Production of oxygen. The role of oxygen in Nature. Sulfur, its physical and chemical properties.

Hydrogen sulfide. Oxides of sulfur. Sulfuric acid, its properties and production. Test reaction for sulfate anion.

Properties of elements from VA group. Phosphorus, its allotropic modifications, physical and chemical properties. Phosphorus (V) oxide, phosphoric acid and its salts. Nitrogen, its physical and chemical properties. Ammonia and ammonium salts. Nitrogen oxides. Nitric acid. Nitrates. Decomposition of nitrates.

Properties of elements from IVA group. Carbon and its compounds. Carbonic acid and its salts. Test reaction for carbonate anion. Silicon. Silicon (IV) oxide. Silicates.

Metals, their position in the Periodic table, physical and chemical properties. Electrochemical series of metals.

Alkali metals and their properties. Compounds of sodium and potassium widespread in Nature, their applications.

Properties of elements from group IIA. Calcium, application of its compounds in medicine.

Aluminum. Amphoteric properties of its oxide and hydroxide. Iron, its oxides and hydroxides, dependence of their features on the oxidation state of iron.

Part 8. Organic chemistry

Theory of organic compounds structure created by A. M. Butlerov. Dependence between structure and chemical features. Isomers. Classification of organic compounds.

Alkanes – saturated hydrocarbons, sp^3 -hybridization of their carbon atoms, nomenclature, physical and chemical properties, production and applications.

Alkenes, sp^2 -hybridization of their carbon atoms, sigma and pi bonds, nomenclature, chemical properties, production and applications. Ethylene. Dienes, Polymerization reactions.

Alkynes, sp^1 -hybridization of their carbon atoms, nomenclature, chemical properties, production and applications. Acetylene.

Arenes – aromatic hydrocarbons. Benzene, its electron structure, chemical properties. Benzene homologues. Toluene. Production of benzene and its homologues.

Alcohols. Classification and nomenclature. Physical and chemical properties. Methanol and ethanol, their applications. Ethylene glycol and glycerol, their applications.

Aromatic alcohols and phenols. Chemical properties of phenol in comparison with those of aliphatic alcohols. Applications of phenol.

Aldehydes, their structure and chemical properties. Production and application of methanal and ethanal.

Carboxylic acids, the structure of carboxylic group. Physical and chemical properties of carboxylic acids. Formic, acetic, stearic and oleic acids.

Esters, their structure, production and chemical properties. Fats, their chemical and physical properties.

Carbohydrates. Their classification. Glucose, its structure and chemical properties, production and applications. Fructose, ribose and deoxyribose.

Disaccharides. Sucrose, its structure, physical and chemical properties. Sucrose hydrolysis.

Polysaccharides. Starch and cellulose, their structure, chemical properties, role in Nature and applications.

Aliphatic and aromatic amines. Their physical and chemical properties. Production of aniline from nitrobenzene.

Amino acids, their structure, chemical properties, production and applications.

Proteins. Their structure and biological roles.