HEALTH MINISTRY OF UKRAINE
Odesa National Medical University

"APPROVED"
Rector of Odesa National Medical University,
Acad. _____ V. M. Zaporozhan
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CHEMISTRY PROGRAM

for people who want to get a higher education

on the basis of complete general secondary education

Odesa, 2021

The program is designed for external independent assessment in chemistry.

The main goal is an objective and impartial assessment of the level of academic achievement of persons who have graduated from secondary school and expressed a desire to enter the Odessa National Medical University.

The task of assessment in chemistry is to assess the knowledge and skills of participants: students' knowledge of the most important laws and theories of chemistry;

• knowledge of chemical language, the ability to use the names and symbols of chemical elements, the names of simple and complex substances;

• ability to compose chemical formulas and equations of chemical reactions, to solve computational and experimental problems;

• understanding the relationship between the composition, structure, physical and chemical properties of substances, methods of their extraction, areas of application;

• knowledge of the most important natural and artificial substances, their structure, methods of extraction and areas of application;

• understanding of the scientific basis of certain chemical industries;

• awareness of some environmental issues related to chemistry;

• understanding the role of chemistry in solving global problems of mankind.

The program on chemistry was developed on the basis of current chemistry curricula for grades 7-9 (Kyiv: Irpin: Perun, 2005) and grades 10-11 of secondary schools (Ternopil: Mandrivets, 2011), electronic versions of which are posted on the official website. website of the Ministry of Education and Science, Youth and Sports (www.mon.gov.ua).

The program in chemistry focuses on achieving state requirements for the level of general education of students of secondary schools. At the same time, it is important not only for students to master chemical concepts, laws, theories, but also for their meaningful use of knowledge, formulation of evaluative judgments, and identification of one's own position in various life situations.

The material of the program is divided into four thematic blocks: "General Chemistry", "Inorganic Chemistry", "Organic Chemistry", "Calculations in Chemistry", which in turn are divided into sections and topics. Each section lists the knowledge that applicants must have.

The list of requirements given in the column "Subject skills and methods of educational activities" reveals in detail the scope of requirements for knowledge and skills in each section and topic.

The names of organic compounds comply with the latest IUPAC recommendations. This material can be found in textbooks marked by the Ministry of Education and Science of Ukraine (see the list of recommended textbooks).

The program uses the abbreviation "n. c." - normal conditions (temperature 0 ° C, pressure 101.3 kPa or 760 mm Hg).

According to international standards, the letters n or ν can be used to indicate the amount of a substance. To denote the thermal effect of the reaction, the notation "ΔH" should be used.

During the preparation it is recommended to use reference tables, which are given in the appendices "Solubility of acids, salts, bases and amphoteric hydroxides in water at 20-25 ° C", "Range of metal activity", "Common names and composition of some inorganic substances, mixtures and minerals "," The most common names and composition of some organic substances and mixtures "," List of recommended reading ".

The program was discussed and approved at the meeting of the admissions committee of Odesa National Medical University (Minutes № 3 of January 25, 2021)

The program was approved by the order of the rector of Odesa National Medical University № 35 of January 26, 2021.

CONTENT

№	Title of the section, topic	Knowledge	Subject skills and methods of educational activity
1. General chemistry			
1.1	Basic chemical concepts. Substance	The concept of substance, physical body, material, simple substance (metal, nonmetal), complex substance, chemical element; the smallest particles of matter - atom, molecule, ion (cation, anion). The composition of the substance (qualitative, quantitative). Valence of a chemical element. Chemical (simplest, true) and graphical (structural) formulas. Physical phenomenon. Relative atomic and molecular mass, molar mass, amount of substance. Units of measurement of the amount of substance, molar mass, molar volume; values of temperature and pressure that correspond to normal conditions (n. c.); molar volume of gas (n. c.). Avogadro's law; Avogadro's number; average relative molecular weight of a mixture of gases, air. Mass fraction of an element in a compound.	Make formulas of compounds according to the values of valence of elements. Write chemical and graphical (structural) formulas of substances. Distinguish between physical bodies and substances; simple and complex substances; elements and simple substances; metals and non-metals; atoms, molecules and ions (cations, anions); physical and chemical properties of the substance; physical phenomena and chemical reactions; the simplest and truest formula of the compound. Determine the valence of elements in binary compounds. Analyze the qualitative (elemental) and quantitative composition of a substance according to its chemical formula.

1.2	Chemical reaction	Chemical reaction, reaction scheme, chemical equation. Laws of conservation of mass of substances during a chemical reaction, volume ratios of gases in a chemical reaction. External effects that accompany chemical reactions. The concept of oxidant, reducing agent, oxidation, reduction. Types of chemical reactions. The rate of a chemical reaction. Catalyst.	Write reaction schemes, chemical equations. Distinguish the types of reactions by the number of reagents and products (coupling, decomposition, exchange, substitution), changes in the degree of oxidation of elements (redox and non-redox reactions), thermal effect (exothermic, endothermic reactions), direction of flow, reversible reactions, irreversible). Determine in the redox reaction oxidant and reducing agent, oxidation and reduction processes. Analyze the effect of reagent concentration, surface size of their contact, temperature, catalyst on the rate of chemical reaction. Apply the law of conservation of mass of substances to convert the reaction scheme to a chemical equation. Use the electronic balance method to convert the redox reaction scheme to a chemical equation.
1.3	Periodic law and periodic table of chemical elements D.I. Mendeleev	Periodic law (modern wording). The structure of short and long variants of the periodic table; periods, groups, subgroups (main, side). Ordinal (atomic) number of the element, placement of metallic and non-metallic elements in the periodic table, periods and groups; alkaline, alkaline earth, inert elements, halogens.	Distinguish in the periodic table periods, groups, major and minor subgroups; metallic and non-metallic elements according to their position in the periodic table. Use the information contained in the periodic table to determine the type of element (metallic or non-metallic element), the maximum value of its valence, the type of simple substance (metal or non-metal), the chemical nature of oxides, hydroxides, compounds of elements with hydrogen. Analyze changes in the properties of simple substances depending on the placement of elements in periods, subgroups, in the transition from one period to another.

1.4	The structure of the atom	The composition of the atom (nucleus, electron shell). The concept of nucleon, nuclide, isotopes, proton number, nucleon number, orbital, energy level and sublevel, paired and unpaired electrons, atomic radius (simple ion); ground and excited states of the atom. The essence of the phenomenon of radioactivity. Forms of s- and p-orbitals, placement of p-orbitals in space. The sequence of electron filling of energy levels and sublevels in atoms of elements № 1-20, electronic and graphical formulas of atoms and simple ions of elements № 1-20.	Write the electronic and graphical formulas of atoms and simple ions of elements № 1-20, atoms of nonmetallic elements of the 2nd and 3rd periods in the excited state. Determine the composition of nuclei (number of protons and neutrons in a nuclide) and electron shells (energy levels and sublevels) of atoms of elements № 1-20. Compare the radii of atoms and simple ions. Analyze changes in the radii of atoms in periods and subgroups.
1.5	Chemical bond	The main types of chemical bonds (ionic, covalent, hydrogen, metallic). The characteristics of a covalent bond are multiplicity, energy, and polarity. Types of crystal lattices (atomic, molecular, ionic, metallic); dependence of physical properties of the substance on the type of crystal lattice. Electronic molecule formula. Electronegativity of the element. The degree of oxidation of the element in the substance.	Compose electronic formulas of molecules, chemical formulas of compounds according to the degrees of oxidation of elements, ion charges. Distinguish between valence and oxidation state of the element. Calculate the degree of oxidation of the element in the compound. Determine the multiplicity, polarity or non-polarity of the covalent bond between atoms. Predict the type of chemical bond in the compound, the physical properties of the substance, taking into account the type of crystal lattice.

1.6	Mixtures of substances. Solutions	Mixtures are homogeneous (solutions) and inhomogeneous (suspension, emulsion, foam, aerosol). Mass and volume (for gas) of the substance in the mixture. Methods of separation of mixtures (settling, filtration, centrifugation, evaporation, distillation). The concept of solution, solvent, solute, crystal hydrate, electrolytic dissociation, electrolyte, non-electrolyte, degree of electrolytic dissociation, ionic-molecular equation. Mass fraction of solute in solution. Water molecule structure; hydrogen bond in water. Coloring of indicators (universal, litmus, phenolphthalein, methyl orange) in acidic, alkaline and neutral environments. Exchange reactions between electrolytes in solution.	To make schemes of electrolytic dissociation of bases, acids, salts; ionic-molecular equations by molecular equations and molecular equations by ionic-molecular equations. Distinguish between homogeneous and inhomogeneous mixtures of different types; diluted, concentrated, saturated, unsaturated solutions; electrolytes and non-electrolytes, strong and weak electrolytes. Determine the possibility of the exchange reaction between electrolytes in solution. Analyze the influence of the structure of substances, temperature, pressure (for gases) on their solubility in water; mechanisms of ion formation when electrolytes of ionic and molecular structure are dissolved in water. Apply knowledge to choose the method of separation of a homogeneous or inhomogeneous mixture of substances.
2. Inorganic chemistry			
2.1. The main classes of inorganic compounds			
2.1.1.	Oxides	Definition, names, classification of oxides, chemical properties of salt-forming oxides, methods of extraction of oxides	Compile chemical formulas of oxides; equations of reactions that characterize the chemical properties of salt-forming oxides (interaction with water, oxides, acids, alkalis), methods of extracting oxides (interaction of simple and complex substances with oxygen, decomposition of insoluble bases, some acids and salts during heating). Name the oxides according to their chemical formulas. Determine the formulas of oxides among the formulas of compounds of other studied classes. Distinguish non-salt-forming (CO, N2O, NO, SiO) and salt-forming oxides (acidic, basic, amphoteric). Compare the chemical properties of basic, acid and amphoteric (for example, oxides of Zinc and Aluminum) oxides. Determine the dependence of the properties of oxides on the type of element and the chemical bond in the compound.

2.1.2.	Foundations	Definition (general and in terms of electrolytic dissociation), names, classification, chemical properties, methods of obtaining bases	Make chemical formulas of bases; equations of reactions that characterize the chemical properties of alkalis (interaction with acid oxides, acids and salts in solution) and insoluble bases (interaction with acids, decomposition during heating), methods of extracting alkalis (interaction of alkali and alkaline earth (except magnesium) metals with water, basic oxides of alkaline and alkaline earth elements with water) and insoluble bases (interaction of salts with alkalis in solution). Name the bases according to their chemical formulas. Determine the formulas of bases among the formulas of compounds of other studied classes. Distinguish between soluble (alkalis) and insoluble bases. Compare the chemical properties of soluble (alkalis) and insoluble bases.
2.1.3.	Acids	Definition (general and in terms of electrolytic dissociation), names, classification, chemical properties, methods of acid extraction	Compile chemical formulas of acids; equations of reactions that characterize the chemical properties of acids (interaction with metals, basic oxides, bases and salts in solution) and methods of their production (interaction of acid oxides with water, non-metals with hydrogen, salts with acids). Name acids according to their chemical formulas. Determine the formulas of acids among the formulas of compounds of other studied classes, the valence of the acid residue by the formula of the acid. Distinguish acids by composition (oxygen-containing, oxygen-free), ability to electrolytic dissociation (strong, weak) and basicity.
2.1.4.	Salts	Definition (general and in terms of electrolytic dissociation), names, classification, chemical properties, methods of salt extraction	Compose chemical formulas of medium and acid salts; equations of reactions that characterize the chemical properties of medium salts (interaction with metals, acids - chloride, sulfate, nitrate, alkalis, salts in solution) and methods of their extraction (interaction of acids with metals, basic oxides with acids, acid oxides with alkalis, alkalis with acids, salts with acids, salts with alkalis, acid oxides with basic oxides, salts with salts, salts with metals (reactions are carried out in solutions), metals with nonmetals). Name medium and acid salts according to their chemical formulas. Determine the formulas of medium and acid salts among the formulas of compounds of other studied classes. Distinguish between medium and acid salts.

2.1.5.	Amphoteric compounds	The phenomenon of amphotericity (on the examples of oxides and hydroxides); chemical properties, methods of extraction of amphoteric hydroxides	Compose reaction equations that characterize the chemical properties of oxides and hydroxides of Aluminum and Zinc (interaction with acids, alkalis) and methods of obtaining hydroxides of Aluminum and Zinc (interaction of salts of these elements with alkalis in solution, aluminates and zinc with acids).
2.1.6.	Genetic links between classes of inorganic compounds		Compose the equations of reactions between inorganic compounds of different classes. Compare the chemical properties of oxides, bases, acids, amphoteric hydroxides, salts. Establish links between the composition and chemical properties of oxides, acids, bases, amphoteric hydroxides, salts; genetic links between simple substances, oxides, bases, acids, amphoteric hydroxides, salts.
2.2. Metal elements and their compounds. Metals			
2.2.1.	General information about metal elements and metals	Position of metal elements in the periodic table; features of the electronic structure of atoms of metal elements; features of metal connection; general physical and chemical properties of metals, general methods of their extraction; a number of activity of metals; the phenomenon of corrosion, ways to protect metals from corrosion; alloys based on iron (cast iron, steel).	Determine the position of metal elements in the periodic table. Characterize the metal bond, metal crystal lattices, physical properties of metals. Distinguish between metallic and non-metallic elements by the electronic structure of atoms. To make electronic formulas of atoms of metal elements - Lithium, Sodium, Magnesium, Aluminum, Potassium, Calcium, Iron; reaction equations that characterize the chemical properties of metals (interaction with oxygen, halogens, sulfur, water, solutions of acids, alkalis and salts) and methods of their extraction (reduction of oxides with coke, carbon (II) oxide, hydrogen, metallothermy (aluminothermy)); equations of reactions that occur during the production of iron and steel. Explain the dependence of the chemical activity of metals on the electronic structure of their atoms; the essence of metal corrosion; chemical transformations during the production of cast iron and steel. Predict the possibility of chemical reactions of metals with water, solutions of acids, salts, alkalis.

2.2.2.	Alkaline and alkaline earth elements	Chemical properties of sodium, potassium, magnesium, calcium; names and formulas of the most important compounds of alkaline and alkaline earth elements; use of compounds of Sodium, Potassium, Magnesium, Calcium; chemical formulas and names of the most important potassium fertilizers; water hardness.	Characterize the position of Sodium, Potassium, Magnesium, Calcium in the periodic table, the physical properties of sodium and potassium, magnesium and calcium, types of water hardness - temporary, or carbonate; constant, general; application of oxides of Magnesium and Calcium, hydroxides of Sodium, Potassium, Magnesium and Calcium. To compose electronic formulas of atoms and ions of Sodium, Potassium, Magnesium, Calcium; equations of reactions that characterize the chemical properties of sodium, potassium, magnesium, calcium (interaction with oxygen, halogens, sulfur, water), oxides and hydroxides of Sodium, Potassium, Magnesium, Calcium; reaction equations used to reduce or eliminate the hardness of water (by boiling, adding soda or lime).
2.2.3.	Aluminum	Chemical properties, extraction and application of aluminum; names and formulas of the most important compounds of Aluminum.	Characterize the position of aluminum in the periodic table, the physical properties of aluminum, oxide and hydroxide of aluminum, the use of aluminum. Compose electronic formulas of the atom and ion of aluminum; reaction equations that characterize the chemical properties of aluminum (interaction with oxygen, halogens, sulfur, solutions of acids, alkalis and salts), amphoteric oxide and hydroxide of aluminum (interaction with basic and acid oxides, acids and alkalis).
2.2.4.	Iron	Chemical properties and extraction of iron; names and formulas of the most important compounds of iron; use of iron and iron compounds.	Characterize the position of iron in the periodic table, the physical properties of iron, oxides and hydroxides of iron; use of iron and iron compounds; physiological role of iron ions. Compose the electronic formula of the iron atom; equations of reactions that characterize the chemical properties of iron (interaction with oxygen, chlorine, sulfur, water vapor, solutions of acids and salts, rust), oxides and hydroxides of iron (interaction with acids), salts of iron (interaction with solutions of alkalis, acids, salts) , interconversion of compounds of Iron (II) and Iron (III).
2.3. Non-metal elements and their compounds. Non-metals			
2.3.1.	Halogens	Chemical formulas of fluorine, chlorine, bromine, iodine; chemical formulas, names and physical properties of the most important compounds of halogens (hydrogen chloride,	Compose the equations of reactions characteristic of chlorine (interaction with metals, non-metals, water), hydrogen chloride and hydrochloric acid (interaction with metals, basic oxides, bases, amphoteric compounds, salts); equations of reactions for the

		halides of metallic elements); methods of laboratory production and chemical properties of hydrogen chloride and hydrochloric acid; the most important applications of chlorine, hydrogen chloride, hydrochloric acid; qualitative reaction for the detection of chloride ions.	production of hydrogen chloride in the laboratory. Compare the chemical activity of halogens. Describe the most important applications of chlorine (as an oxidant in the production of organic and inorganic substances), hydrogen chloride, hydrochloric acid (in the production of plastics, for the extraction of chlorides), chlorides (sodium chloride - food seasoning, for the extraction of chlorine, sodium, sodium hydroxide). Apply knowledge to choose the method of detecting chloride ions in solution.
2.3.2.	Oxygen and Sulfur	Chemical formulas of oxygen, ozone, sulfur and the most important compounds of Oxygen and Sulfur; physical and chemical properties of oxygen, ozone, sulfur, oxides of sulfur, sulfuric acid, sulfates; methods of oxygen extraction in the laboratory; the most important applications of oxygen, ozone, sulfur, sulfuric acid and sulfates; qualitative reaction for the detection of sulfate ions.	Compose the equations of reactions characteristic of oxygen (interaction with metals, nonmetals, compounds of nonmetallic elements with hydrogen), sulfur (interaction with metals, some nonmetals), sulfur oxides (interaction with water, basic oxides, bases), sulfuric acid (interaction with metals), basic oxides, bases, amphoteric compounds, salts); equations of reactions of oxygen extraction in the laboratory, formation and decomposition of ozone. Compare the composition, chemical activity of oxygen and ozone. Describe the most important applications of oxygen (as an oxidant), ozone (disinfection of water), sulfur (extraction of sulfuric acid; production of rubber, matches, anti-inflammatory drugs, cosmetics), sulfuric acid (production of fertilizers, fibers) and sulfates - in construction, medicine, copper sulphate - to control plant pests, wood pickling). Apply knowledge to choose the method of detecting oxygen and sulfate ions (in solution).
2.3.3.	Nitrogen and Phosphorus	Chemical formulas of nitrogen, white and red phosphorus, the most important compounds of Nitrogen and Phosphorus; physical and chemical properties of nitrogen, white and red phosphorus, nitrogen (II) oxide, nitrogen (IV) oxide, phosphorus (V) oxide, ammonia, ammonium salts, nitric acid, nitrates, orthophosphate acid, orthophosphates; methods of obtaining ammonia, nitric and orthophosphate acids in the laboratory; the most important applications of nitrogen,	basic oxides, bases) , amphoteric compounds, salts), nitrogen (IV) oxide and phosphorus (V) oxide (interaction with water, basic oxides, bases), orthophosphate acid (interaction with metals, basic oxides, bases, salts); equations of reactions that characterize the interconversion of medium and acid orthophosphates; equations of reactions of thermal decomposition of ammonium salts (chloride, nitrate, carbonate and bicarbonate) and nitrates; equations of reactions of extraction of ammonia, nitric and orthophosphate acids in the laboratory. Characterize the composition and structure of simple substances Phosphorus (red and white phosphorus), the most important

		ammonia, nitric acid, nitrates, orthophosphate, orthophosphates; qualitative reactions for the detection of ammonium ions and orthophosphate ions.	applications of nitrogen (ammonia production, low temperatures), ammonia (nitric acid production, fertilizer production, ammonia), nitric acid (fertilizer production, explosives, nitrous) organic compounds), nitrates (production of fertilizers, explosives), orthophosphate acid and orthophosphates (production of fertilizers). Compare the chemical activity of nitrogen, red and white phosphorus. Apply knowledge to choose the method of detection of ammonia, ammonium ions and orthophosphate ions (in solution).
2.3.4.	Carbon and Silicon	Simple Carbon substances; adsorption, adsorption properties of activated carbon; chemical formulas of the most important compounds of Carbon and Silicon; physical and chemical properties of carbon, silicon, carbon oxides, carbonates, silicon (IV) oxide, silicate acid, silicates; methods of extracting carbon oxides in the laboratory; the most important applications of diamond, graphite, activated carbon, carbon oxides, carbonates, bicarbonates, silicon (IV) oxide, silicates; qualitative reactions for the detection of carbonate and silicate ions.	Compose the equations of reactions characteristic of carbon and silicon (interaction with active metals and nonmetals, oxides of metallic elements), carbon (II) oxide (interaction with oxygen, oxides of metallic elements), carbon (IV) oxide (interaction with water, basic oxides, alkalis, carbon), silicon (IV) oxide (interaction with basic oxides, alkalis); equations of reactions of interconversion of medium and acid carbonates, thermal decomposition of carbonates and bicarbonates, extraction of Carbon oxides in the laboratory. To characterize the composition, structure and physical properties of simple substances Carbon (graphite, diamond, carbine), the most important applications of diamond (in cutting and grinding tools), graphite (in the manufacture of pencils, electrodes), activated carbon (in medicine, in gas masks, for water purification), Carbon oxides (CO as a reducing agent, CO2 - in the production of soda, sugar, carbonated beverages, extinguisher fillers), sodium bicarbonate, Calcium and Sodium carbonates, silicon (IV) oxide (glass production, building materials), silicates (components of cement, ceramics, porcelain, liquid glass). Apply knowledge to choose the method of detection of carbon (IV) oxide, carbonate and silicate ions (in solution).
3. Organic chemistry			
3.1.	Theoretical foundations of organic chemistry	The most important elements are organogens, organic compounds; natural and synthetic organic compounds. Molecular structure of organic compounds.	Identify the most important elements-organogens (C, H, O, N, S, P). Distinguish by characteristic features inorganic and organic compounds, natural and synthetic organic compounds.

		Chemical bond in molecules of organic compounds: energy, length, spatial orientation, polarity. σ-Connection and π-connection. Single, multiple (double, triple), aromatic bonds.	Characterize the multiplicity, polarity or non-polarity of a covalent bond in molecules of organic compounds, σ- and π-bonds by the method of formation. Compare single, double, triple and aromatic bonds by energy and length and spatial orientation. Analyze the reactivity of organic compounds with different types of bonds.
		Hybridization of electron orbitals of the carbon atom; sp3-, sp2-, sp-hybridization.	Determine the types of hybridization and spatial orientation of hybrid electron orbitals of carbon atoms in molecules of organic compounds.
		Classification of organic compounds by the structure of the carbon chain and the presence of characteristic (functional) groups.	Classify organic compounds according to the structure of the carbon chain into saturated hydrocarbons of acyclic structure - alkanes, unsaturated hydrocarbons of acyclic structure - alkenes, alkynes; cyclic hydrocarbons - cycloalkanes and arenes; in the presence of characteristic (functional) groups for alcohols, phenol, haloalkanes, aldehydes, carboxylic acids, esters, amines, amino acids.
		The phenomenon of homology; homologues, homologous series, homologous difference. Classes of organic compounds. General formulas of homologous series and classes of organic compounds.	Determine homologues of hydrocarbons and their derivatives. Distinguish homologous series and classes of organic compounds. Establish correspondences between representatives of homologous series and their general formulas, classes of organic compounds and their characteristic (functional) groups.
		The concept of primary (secondary, tertiary, Quaternary) carbon atom.	Determine the molecules of organic compounds of different structure of primary, secondary, tertiary, Quaternary carbon atoms.
		Nomenclature of organic compounds.	Name organic compounds according to structural formulas, using the IUPAC nomenclature.
		The phenomenon of isomerism, isomers, structural and spatial (geometric, or cis-trans-) isomerism.	Determine isomers by structural formulas. Distinguish between structural and spatial (geometric, or cis- and trans-) isomers. To establish differences between isomers and homologues by: qualitative and quantitative composition, structure of molecules.

		Interaction of atoms or groups of atoms in molecules of organic compounds.	Establish a relationship between the structure and properties of organic compounds, taking into account the redistribution of electron density on the examples of propene (addition of hydrogen halides and water according to the rule of V. Markovnikov); alcohols (similarity to acids); phenol (acidic properties, ability to substitution reactions in the benzene ring); saturated monobasic carboxylic acids (acidic properties), amines (basic properties, the ability of aniline to substitution reactions in the benzene ring). Analyze the chemical structure of organic compounds, using the basic provisions of the theory of O. Butlerov. Predict the reactivity of organic compounds using the concept of the interaction of atoms or groups of atoms in molecules.
		Classification of chemical reactions in organic chemistry (addition, substitution, isomerization reactions).	Classify reactions involving organic compounds (substitution, addition, cleavage, isomerization). Establish links between the structure of molecules of organic compounds and their ability to enter into reactions of a certain type.
3.2. Hydrocarbons			
3.2.1.	Alkanes	General formula of alkanes, their nomenclature, isomerism, structure of molecules, physical and chemical properties, methods of extraction, application.	Name the first 10 representatives of the homologous series of alkanes according to the IUPAC nomenclature. Compile molecular and structural formulas of alkanes; equations of reactions characterizing the chemical properties of alkanes (substitution reaction on the example of methane chlorination, complete oxidation of alkanes or partial oxidation of methane, thermal decomposition of methane, cracking, isomerization of alkanes), laboratory method of methane extraction. Explain the phenomenon of sp3-hybridization of electron orbitals of carbon atoms in alkane molecules. Compare the physical properties of alkanes on the example of their boiling and melting points. Justify the relationship between the physical state under normal conditions, melting and boiling points of alkanes and their relative molecular weight; the ability of alkanes to substitution reactions by the electronic structure of molecules, the use of alkanes (fuel, fuel, solvents, extraction of soot, hydrogen, halogenated alkanes) by their properties. Establish links between the structure of molecules and the

			properties of alkanes.
3.2.2.	Alkenes	General formula of alkenes, their nomenclature, isomerism, structure of molecules, chemical properties, methods of extraction, application; qualitative reactions to the double bond.	Determine the structural isomers of alkenes by the structure of the carbon chain, the location of the double bond; intergroup (alkenes and cycloalkanes) and spatial (geometric or cis-trans-) isomers. Name alkenes according to the IUPAC nomenclature. Compose molecular, structural formulas of alkenes; equations of reactions characterizing the chemical properties of ethene and propene (reactions of hydrogen, halogens, halogens, water; polymerization, partial oxidation of ethene and complete oxidation of alkenes), industrial and laboratory methods of alkene extraction (thermal cracking of alkanes, dehydration monohydric alcohols, the interaction of haloalkanes with an alcoholic solution of alkali, the reaction of alkynes with hydrogen), the extraction of ethene in the laboratory. Explain the phenomenon of sp2-hybridization of electron orbitals of carbon atoms in alkene molecules. Apply knowledge to choose the method of detection of ethene (interaction with bromine water, aqueous solution of potassium permanganate), alkenes (interaction with bromine water). Justify the use of alkenes (production of polyethylene, polypropylene, ethanol, 1,2-dichloroethane) by their properties. Establish links between the structure and ability of alkenes to join reactions. Analyze the addition of hydrogen halides and water to propene according to the redistribution of electron density in the molecule (V. Markovnikov's rule).
3.2.3.	Alkynes	General formula of alkynes, their nomenclature, isomerism, structure of molecules; chemical properties and methods of ethine extraction, application; qualitative reactions to the triple bond.	Determine the structural isomers of alkynes by the structure of the carbon chain, the location of the triple bond. Name alkynes according to the IUPAC nomenclature. Compile molecular and structural formulas of alkynes; equations of reactions characterizing the chemical properties of acetylene (reactions of hydrogen, halogens, halogens, water) (reaction of M. Kucherov), substitution reactions - interaction with sodium, ammonia solution of argentum (I) oxide, trimerization of acetylene, complete oxidation of alkynes and), industrial and laboratory methods of acetylene extraction (thermal decomposition of

			methane, interaction of calcium acetylenide with water, reaction of 1,2-dichloroethane with an alcoholic solution of alkali). Justify the use of acetylene (gas cutting and welding of metals; extraction of vinyl chloride, polyvinyl chloride, acetaldehyde), due to its properties. Explain the phenomenon of sp-hybridization of electron orbitals of carbon atoms in alkyne molecules. Apply knowledge to select a method for detecting acetylene (interaction with bromine water, aqueous solution of potassium permanganate, ammonia solution of argentum (I) oxide), alkynes containing molecules of CH bonds (interaction with bromine water, ammonia solution of argen I) oxide). Compare the reactivity of ethene and ethyne in addition reactions. Establish a link between the structure and the ability of acetylene to join, substitution reactions.
3.2.4.	Aromatic hydrocarbons. Benzene.	The general formula of arenes of the homologous series of benzene. Structure, properties, methods of benzene extraction; the concept of aromatic bonds, 6π-electronic system.	Make the molecular and structural formulas of benzene; equations of reactions characterizing the chemical properties of benzene (substitution reactions involving halogens, addition reactions - hydrogenation and chlorination (hν), oxidation), benzene extraction in industry (catalytic dehydrogenation of hexane, cyclohexane, acetylene trimerization). Distinguish between unsaturated and aromatic hydrocarbons. Explain the phenomenon of sp2-hybridization of electron orbitals of carbon atoms in the benzene molecule, the resistance of benzene to oxidants and its ability to substitution reactions. Compare the bonds between the carbon atoms in the molecules of benzene, alkanes and alkenes, the reactivity of benzene, alkanes and alkenes in the substitution and oxidation reactions.
3.2.5.	Natural sources of hydrocarbons and their processing	Oil, natural and associated petroleum gases, coal, their composition; cracking and aromatization of oil and oil products, detonation resistance of gasoline, octane number; coal processing; problems of extraction of liquid fuel from coal and alternative sources.	Name the products of oil and coal refining. Give examples of the use of natural hydrocarbons as sources of organic compounds. Compose the equations of reactions that occur during the combustion of natural gas. Distinguish the reactions that occur during cracking and aromatization of hydrocarbons. Compare the detonation resistance of gasolines taking into account their octane numbers.

3.3. Oxygen-containing organic compounds			
3.3.1.	Alcohols	Characteristic (functional) group of alcohols. Classification of alcohols. General formula of monohydric saturated alcohols. Structure, nomenclature, isomerism, properties, methods of extraction and application. The concept of hydrogen bonding.	Determine the structural isomers of monohydric saturated alcohols by the structure of the carbon chain, the location of the hydroxyl group and interclass isomers (ethers). Name monohydric saturated alcohols, as well as ethylene glycol and glycerol according to the IUPAC nomenclature. To classify alcohols according to the structure of the carbon chain - saturated, unsaturated, by the number of hydroxyl groups - mono- and polyhydric, by the nature of the carbon atoms to which the hydroxyl group is connected - primary, secondary, tertiary alcohols. To make molecular, structural formulas of alcohols; equations of reactions reflecting the chemical properties of saturated monohydric alcohols and glycerol (substitution reactions - interaction with active metals, hydrogen halides, esterification, intermolecular dehydration, intramolecular dehydration, partial and complete oxidation), industrial methods for the production of methanol from methanol hydration of ethene, enzymatic fermentation of glucose, ethanol reduction) and laboratory methods of alcohol production (hydrolysis of haloalkanes). To characterize the composition and structure of molecules of monohydric saturated alcohols. Justify the use of ethanol (extraction of acetic acid, diethyl ether) and methanol (extraction of formaldehyde) by their properties. Compare the physical properties (boiling point, solubility in water) of monohydric saturated alcohols and the corresponding alkanes, methanol, ethanol, ethylene glycol and glycerol; activity of monohydric saturated alcohols, water and inorganic acids in reactions with alkali metals. Establish links between the electronic structure of molecules of monohydric saturated alcohols and their physical and chemical properties.

		Ethylene glycol and glycerol as representatives of polyhydric alcohols; qualitative reaction to polyhydric alcohols.	Compose equations of reactions that reflect the chemical properties of ethylene glycol and glycerol (interaction with sodium, copper (II) hydroxide (without writing the reaction equation), complete oxidation); glycerol (interaction with nitric acid, higher saturated and unsaturated carboxylic acids); extraction of glycerol (saponification of fats). Establish links between the structure of molecules of polyhydric alcohols and their properties. Apply knowledge to choose a method for detecting polyhydric alcohols (interaction with copper (II) hydroxide).
3.3.2.	Phenol	Phenol formula. The structure of the phenol molecule, the characteristic (functional) group in it; properties, extraction, application; qualitative reactions to phenol.	Make molecular, structural formulas of phenol; equations of reactions that reflect the chemical properties of phenol (reactions involving the hydroxyl group - interaction with sodium, sodium hydroxide; reactions involving the benzene ring - interaction with bromine water, nitric acid), its extraction in industry (hydrolysis of chlorobenzene). Justify the mutual influence of the hydroxyl group and the benzene ring in the phenol molecule. Compare the acidic properties of alcohols, phenol and carboxylic acid; the ability of benzene and phenol to substitution reactions. Establish links between the structure of the phenol molecule and its properties. Apply knowledge to choose the method of detection of phenol (interaction with iron (III) chloride, bromine water).
3.3.3.	Aldegidi	General formula of aldehydes. Structure of aldehyde molecules, characteristic (functional) group, nomenclature, isomerism, properties, extraction, application; qualitative reactions to the aldehyde group.	Determine the structural isomers of aldehydes by the structure of the carbon chain. Name aldehydes according to the IUPAC nomenclature. Give examples of the use of ethanal (extraction of acetic acid, ethyl alcohol) and methanol (extraction of formalin, urotropin) by their properties. Compose structural formulas of aldehyde molecules and their structural isomers; equations of reactions that reflect the chemical properties of aldehydes (reduction, partial oxidation), ethanol production in industry (hydration of acetylene by the reaction of M. Kucherov) and the laboratory (oxidation of ethanol). Apply knowledge to choose the method of detection of aldehydes by qualitative reactions - interaction with ammonia solution of

			argentum (I) oxide, copper (II) hydroxide.
3.3.4.	Carboxylic acids	Characteristic (functional) group of carboxylic acids. Classification of carboxylic acids. The general formula of saturated monobasic carboxylic acids. Structure, nomenclature, isomerism of monobasic carboxylic acids, properties, extraction, application.	Determine the structural isomers of saturated monobasic carboxylic acids by the structure of the carbon chain, interclass isomers (esters). Name saturated monobasic carboxylic acids according to the IUPAC nomenclature, to give trivial names to the first three monobasic carboxylic acids. Classify carboxylic acids by the structure of the carbon chain (saturated, unsaturated), the number of carboxyl groups (one-, two-basic) and the number of carbon atoms in their molecules (lower, higher). Formulate structural isomers of saturated monobasic carboxylic acids; reaction equations that reflect the chemical properties of carboxylic acids (interaction with active metals, basic oxides, bases, salts of carboxylic acid, alcohols); equations of methane acid extraction reactions (methane oxidation, interaction of carbon (II) oxide with sodium hydroxide with subsequent action of hydrochloric acid) and ethanoic acid (oxidation of butane, ethanol, ethanol). Justify the ability of lower carboxylic acids to electrolytic dissociation, and their solutions - to change the color of indicators; special chemical properties of methane acid (ability to oxidize - interaction with ammonia solution of argentum (I) oxide, copper (II) hydroxide). Compare the physical properties (boiling point, solubility in water) of saturated monobasic carboxylic acids and monohydric saturated alcohols; acidic properties of carboxylic acids within the homologous series, as well as with alcohols, phenol and inorganic acids. Establish links between the electronic structure of molecules and the physical and chemical properties of carboxylic acids.
3.3.5.	Esther. Fats	General formula of carboxylic acid esters. Structure, nomenclature, isomerism, properties, extraction, application. Fats are esters of glycerol and higher carboxylic acids. Classification of fats, properties, extraction, application. Soaps and	Determine the structural isomers of carboxylic acid esters by the structure of the carbon chain, interclass isomers (carboxylic acids); structural formulas of fats - triolein, tristearin; formulas of salts of palmitic and stearic acids. Name esters according to the IUPAC nomenclature. Classify fats into animal and vegetable; solid and liquid.

		synthetic detergents.	Make the equations of reactions of formation of esters (esterification) and their hydrolysis; equations of reactions that reflect the properties of fats (saponification, hydrogenation). Establish links between the composition, structure of molecules, properties and uses of fats. Apply knowledge to choose how to detect unsaturated liquid fats (interaction with bromine water).
3.3.6.	Carbohydrates	Classification of carbohydrates; composition, molecular formulas of glucose, fructose, sucrose, starch and cellulose; structural formula of the open form of the glucose molecule; properties of glucose, sucrose, starch and cellulose; glucose extraction, production of sucrose and starch; qualitative reactions for the determination of glucose and starch; use of glucose, starch, cellulose.	Distinguish between mono-, di- and polysaccharides. Give examples of the use of glucose, starch (ethanol production) and cellulose (extraction of artificial acetate silk) by their properties. Compose equations of reactions that reflect the chemical properties of glucose (complete and partial oxidation, reduction, alcohol and lactic acid fermentation, esterification, interaction with copper (II) hydroxide without heating (without writing the reaction equation) and with heating), sucrose (complete oxidation, hydro , formation of sugars), starch (acid and enzymatic hydrolysis) and cellulose (complete oxidation, hydrolysis, esterification - formation of triacetate and cellulose trinitrate), photosynthesis. Establish the similarities and differences between starch and cellulose in composition, structure of molecules and properties. Apply knowledge to choose the method of detecting glucose (interaction with ammonia solution of argentum (I) oxide, reaction with copper (II) hydroxide) and starch (interaction with iodine).
3.4. Nitrogen-containing organic compounds			
3.4.1.	Amines	Characteristic (functional) group of amines. Classification of amines. Nomenclature, isomerism, structure, properties, methods of extraction and application.	Determine the structural formulas of isomeric amines by the structure of the carbon chain, the position of the amino group and interspecific isomers (primary, secondary, tertiary amines). Name amines according to the IUPAC nomenclature. Classify amines as ammonia derivatives (primary, secondary and tertiary) and by the structure of the carbon chain (saturated, aromatic). Compose equations of reactions that reflect the chemical properties of saturated amines as organic bases (interaction with water, inorganic acids; combustion); aniline (interaction with inorganic acids, bromine water); aniline extraction (reduction of nitrobenzene - reaction of M. Zinin). Substantiate the main properties of saturated amines and aniline;

			reducing the basic properties and increasing the reactivity of aniline in substitution reactions. Compare the main properties of ammonia, primary, secondary, tertiary saturated amines and aniline.
3.4.2.	Amino acids	Composition and structure of molecules, nomenclature, properties, extraction, application of amino acids. The concept of amphoteric amino acids, bipolar ion; di-, tri-, polypeptides, peptide bond (peptide group of atoms)	Name the amino acids according to the IUPAC nomenclature. To make structural formulas of the simplest amino acids - glycine (aminoethane), alanine (2-aminopropanoic); equations of reactions that reflect the chemical properties of amino acids on the example of the interaction of aminoethanoic acid and 2-aminopropanoic acid with inorganic acids, bases; formation of di-, tri-, polypeptides. Justify the amphotericity of amino acids, the formation of bipolar ions. Compare the structure of molecules and chemical properties of amino acids with carboxylic acids and amines.
3.4.3.	Proteins	The structure of proteins, their properties, applications, color reactions to proteins.	Characterize the processes of hydrolysis, denaturation of proteins. Apply knowledge to choose the method of protein detection (xanthoprotein and biuret reactions).
3.5. Synthetic macromolecular substances and polymeric materials based on them			
	Synthetic macromolecular substances and polymeric materials based on them	The concept of polymer, monomer, elementary unit, the degree of polymerization. Classification of macromolecular substances; methods of synthesis of macromolecular substances; structure and properties of polymers; thermoplastic polymers and plastics based on them; the concept of natural and synthetic rubbers, synthetic fibers; the importance of polymers in the public economy and everyday life.	Classify polymers by production (natural, artificial, synthetic); relation to heating (thermoplastic, thermoreactive); structure (linear, branched, mesh). Compose the equations of polymerization reactions with the formation of the most important polymers (polyethylene, polypropylene, polystyrene, polyvinyl chloride, Teflon, phenol-formaldehyde resins, polyisoprene, polybutadiene, kapron, mylar). Distinguish methods of formation of macromolecular compounds (polymerization and polycondensation reactions). Compare the properties of natural (cotton, linen, silk, wool), artificial (artificial acetate and viscose silk) and synthetic fibers (kapron, mylar). Establish links between the properties and applications of polymers.
3.6. Generalization of knowledge about organic compounds			
	Establishing genetic links between different classes of organic compounds, between organic and inorganic compounds		Compare the chemical properties of organic compounds of different classes. Establish links between the composition and chemical properties of organic compounds of different classes, between organic and

			inorganic compounds; genetic links between organic and inorganic compounds. Compose the equations of reactions - interconversions of organic compounds of different classes.
4. Calculations in chemistry			
4.1.	Solving problems by chemical formulas and deriving the formula of a compound	Formulas for calculating the amount of substance, the number of particles in a certain amount of substance, the mass fraction of the element in the compound, the relative density of the gas, the mass (volume) fraction of the component in the mixture, the derivation of the compound formula by mass fraction of elements	Calculate the relative molecular and molar mass of the substance; the number of particles in a certain amount of substance, mass of substance, volume of gas; the volume of a given mass or quantity of a gas substance per n. in.; the relative density of a gas over another gas; mass and volume (for gases) particles of substances in the mixture; the average molar mass of the gas mixture; mass fraction of the element in the compound according to its formula. Determine the chemical formula of a compound by the mass fractions of its constituent elements.
4.2.	Expression of the quantitative composition of the solution (mixture)	Mass fraction of dissolved substance	Calculate the mass fraction of solute in solution, mass (volume) of solution and solvent, mass of solute. Perform calculations for the preparation of solutions of crystal hydrates.
4.3.	Solving problems by reaction equations	Algorithms for solving problems by the reaction equation; the relative yield of the reaction product	Calculate by mass reaction equation the mass, volume (for gas) or quantity of a substance of a reagent or product by a known mass, volume (for gas) or quantity of a substance of another reagent or product; the relative yield of the reaction product. Establish the chemical formula of a substance based on quantitative data on reagents and reaction products. Perform calculations if substances contain impurities or are present in excess. Solve combined problems (combination of no more than two algorithms).

Table of solubility of bases, acids, amphoteric hydroxides and salts in water at 20–25 ° C

Ions to which the compound dissociates	H^+	NH_4^+	Li^+	Na^+	K^+	Mg^{2+}	Ca^{2+}	Ba^{2+}	Al^{3+}	Cr^{3+}	Zn^{2+}	Mn^{2+}	Fe^{2+}	Fe^{3+}	Pb^{2+}	Cu^{2+}	Ni^{2+}	Ag^+	Hg^{2+}
OH^-		s	s	s	s	p	p	s	i	i	i	i	i	i	i	i	i	–	–
F^-	s	s	p	s	s	p	p	p	p	s	s	s	p	i	p	s	s	s	#
Cl^-	s	s	s	s	s	s	s	s	s	s	s	s	s	s	p	s	s	i	s
Br^-	s	s	s	s	s	s	s	s	s	s	s	s	s	s	p	s	s	i	p
I^-	s	s	s	s	s	s	s	s	s	s	s	s	s	–	p	–	s	i	p
S^{2-}	s	s	s	s	s	#	#	s	#	#	i	i	i	#	i	i	i	i	i
SO_3^{2-}	s	s	s	s	s	s	s	p	–	–	s	p	p	–	p	–	p	i	#
SO_4^{2-}	s	s	s	s	s	s	s	i	s	s	s	s	s	s	p	s	s	p	s
NO_3^-	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s
PO_4^{3-}	s	s	p	s	s	p	i	i	i	i	i	p	i	i	i	#	i	i	#
CO_3^{2-}	s	s	s	s	s	p	i	i	–	–	i	i	i	–	i	#	p	p	–
CH_3COO^-	s	s	s	s	s	s	s	s	s	s	s	s	s	–	s	s	s	s	s

Symbols: "s" - soluble substance (solubility of more than 1 g of substance in 100 g of water);
"p" - poorly soluble substance (solubility - from 1 to 0.001 g in 100 g of water);
"i" - a substance practically insoluble (solubility - less than 0.001 g in 100 g of water);
"-" - the substance does not exist;
"#" - the substance exists but reacts with water; its solubility cannot be determined.

A number of metal activities

Li, K, Ba, Ca, Na, Mg, Al, Mn, Zn, Fe, Ni, Sn, Pb **(H_2)** Cu, Ag, Hg, Pt, Au

The most common names and composition of some inorganic substances, mixtures and minerals

The most common name for a substance or mixture	Chemical formula of a substance or component (s) of a mixture	The most common name for a substance or mixture	Chemical formula of a substance or component (components) of the mixture
Table (rock) salt	$NaCl$	Copper sulphate	$CuSO_4 \cdot 5H_2O$
Caustic soda	$NaOH$	Iron sulphate	$FeSO_4 \cdot 7H_2O$
Soda ash	Na_2CO_3	Bitter salt	$MgSO_4 \cdot 7H_2O$
Crystal soda	$Na_2CO_3 \cdot 10H_2O$	Alum-potassium alum	$KAl(SO_4)_2 \cdot 12H_2O$
Drinking (baking) soda	$NaHCO_3$	Hydrogen peroxide, perhydrol	H_2O_2 (aqueous solution)
Sodium nitrate	$NaNO_3$	Iodine tincture	I_2 (alcohol solution)
Potassium nitrate	KNO_3	Ammonia, ammonia water	NH_3 (aqueous solution)
Ammonium nitrate	NH_4NO_3	Chlorinated lime	$CaCl(OCl)$, або $CaOCl_2$
Ammoniac	NH_4Cl	Soluble glass	Na_2SiO_3
Potash	K_2CO_3	Silicon (semiconductor)	Si
Chalk, marble, limestone	$CaCO_3$	Quartz, quartz sand	SiO_2
Quicklime	CaO	Clay, alumina, kaolin	$Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$
Slaked lime	$Ca(OH)_2$	Glass (window)	$Na_2O \cdot CaO \cdot 6SiO_2$
Lime water	$Ca(OH)_2$ (aqueous solution)	Malachite	$(CuOH)_2CO_3$
boric acid	H_3BO_3	Chlorine water	Cl_2 (aqueous solution)
Corundum	Al_2O_3	Bromine water	Br_2 (aqueous solution)
Hematite (iron ore)	Fe_2O_3	Bertoletto salt	$KClO_3$
Magnetite (iron ore)	Fe_3O_4	Nitric acid	HNO_3
Minium (red lead)	Pb_3O_4	Hydrochloric acid	HCl (aqueous solution)
Sulfuric acid	H_2SO_4	Hydrofluoric acid	HF (aqueous solution)
Oleum	solution SO_3 y H_2SO_4	Lyapis	$AgNO_3$
Gypsum	$CaSO_4 \cdot 2H_2O$	Manganese	$KMnO_4$
Alabaster	$CaSO_4 \cdot 1/2\ H_2O$	Carbide, calcium carbide	CaC_2
Dry ice	CO_2 (solid)	Phosphoric anhydride	P_2O_5
Hydrogen sulfide	H_2S	Simple superphosphate	$Ca(H_2PO_4)_2 \cdot H_2O + CaSO_4 \cdot 2H_2O$
Sulfur dioxide	SO_2	Double superphosphate	$Ca(H_2PO_4)_2 \cdot H_2O$
Carbon monoxide	CO	Precipitate	$CaHPO_4 \cdot 2H_2O$
Amusement gas, nitrous oxide	N_2O	Urea	$CO(NH_2)_2$
Pyrite	FeS_2	Amophos	$NH_4H_2PO_4 + (NH_4)_2HPO_4$

The most common names and composition of some organic substances and mixtures

The most common name of a substance or mixture	Chemical formula	The most common name of a substance	Chemical formula
swamp gas, mine gas	CH_4	carbolic acid, phenol	C_6H_5OH
isobutane	$(CH_3)_2CHCH_3$	picric acid	2,4,6- trinitrophenol
isopentane	$(CH_3)_2CHCH_2CH_3$	formic acid, formic acid	HCOOH
neopentane	$(CH_3)_4C$	acetic acid, acetic acid	CH_3COOH
isooctane	$(CH_3)_3CCH_2CH(CH_3)_2$	propionic acid, propionic acid	CH_3CH_2COOH
methylene group	$–CH_2–$	sodium formate	HCOONa
diargentum (I) acetylenide	$AgC≡CAg$	magnesium formate, magnesium deformate	$(HCOO)_2Mg$
disodium acetylenide	$NaC≡CNa$	sodium acetate	CH_3COONa
divinyl	$CH_2=CH–CH=CH_2$	calcium acetate, calcium diacetate	$(HCOO)_2Ca$
isoprene	$CH_2=C(CH_3)CH=CH_2$	lactic acid, lactic acid	$CH_3CH(OH)COOH$
methyl chloride	CH_3Cl	oxalic acid, oxalic acid	HOOC–COOH
ethyl chloride	C_2H_5Cl	disodium oxalate	NaOOC–COONa
propyl chloride	$CH_3CH_2CH_2Cl$	methyl formate	$HCOOCH_3$
isopropyl chloride	$(CH_3)_2CHCl$	ethyl formate	$HCOOC_2H_5$
chloroform	$CHCl_3$	methyl acetate	CH_3COOCH_3
iodoform	CHI_3	ethyl acetate	$CH_3COOC_2H_5$
vinyl chloride	$CH_2=CHCl$	sodium methylate	CH_3ONa
methyl alcohol, wood alcohol	CH_3OH	sodium ethylate	C_2H_5ONa
ethyl alcohol, wine alcohol	C_2H_5OH	gluconic acid	$HOCH_2(CHOH)_4COOH$
propyl alcohol	$CH_3CH_2CH_2OH$	sorbitol	$HOCH_2(CHOH)_4CH_2OH$
isopropyl alcohol	$(CH_3)_2CHOH$	sugar acid	$HOOC(CHOH)_4COOH$
dimethyl ether	CH_3OCH_3	calcium saccharate	$C_{12}H_{22}O_{11}·CaO$
diethyl ether, diethyl ether	$C_2H_5OC_2H_5$	glycine, aminoacetic acid	NH_2CH_2COOH
formic aldehyde, formaldehyde	HCHO	alanine, α-aminopropionic acid	$CH_3CH(NH_2)COOH$
formalin	36–37% solution HCHO	pyroxylin	$(C_6H_7O_2(ONO_2)_3)_n$
acetone	CH_3COCH_3	cellulose	$(C_6H_{10}O_5)_n$
nitroglycerin, trinitroglycerin	$CH_2(ONO_2)CH(ONO_2)CH_2(ONO_2)$		

List of recommended educational literature

1. Textbook "Chemistry. 7th grade »/ authors Popel P.P., Kriklya L.S. / K: Academy, 2007.
2. Textbook "Chemistry. 7th grade »/ author Yaroshenko O.G. / K: Stanitsa, 2008.
3. Textbook "Chemistry. 7th grade »/ author Burynska N.M. / K: Perun, 2007.
4. Textbook "Chemistry. 7th grade »/ author Lashevskaya G.A. / K: Genesis, 2007.
5. Textbook "Chemistry. 8th grade »/ authors Popel P.P., Kriklya L.S. / K: Academy, 2008.
6. Textbook "Chemistry. 8th grade »/ author Yaroshenko O.G. / K: Education, 2008.
7. Textbook "Chemistry. 8th grade »/ author Burynska N.M. / K: Perun, 2008.
8. Textbook "Chemistry. 9th grade »/ authors Burynska N.M., Velichko L.P. / K: Perun, 2009.
9. Textbook "Chemistry. 9th grade »/ author Lashevskaya G.A. / K: Genesis, 2009.
10. Textbook "Chemistry. 9th grade »/ authors Popel P.P., Kriklya L.S. / K: Akademiya, 2009.
11. Textbook "Chemistry. 9th grade »/ author Yaroshenko O.G. / K: Education, 2009.
12. Textbook "Chemistry. Grade 10 (standard level, academic level) "/ author Yaroshenko O.G. / K: Gramota, 2010.
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14. Textbook "Chemistry. Grade 10 (profile level) »/ author Burynska N.M. etc. / K: Pedagogical thought, 2010
15. Textbook "Chemistry. Grade 11 (standard level) "/ authors Lashevskaya G.A., Lashevskaya A.A. / K: Genesis, 2011.
16. Textbook "Chemistry. Grade 11 (standard level) "/ author Yaroshenko O.G. / K: Gramota, 2011.
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18. Textbook "Chemistry. Grade 11 (academic level) "/ author Velichko L.P. / K: Education, 2011.
19. Modern terminology and nomenclature of organic compounds / authors Tolmachova V.S., Kovtun O.M., Kornilov M.Yu., Gordienko O.V., Vasylenko S.V. / Ternopil: Textbook - Bogdan, 2008.
20. Nomenclature of organic compounds / authors Tolmachova V.S., Kovtun O.M., Dubovik O.A., Fitsaylo S.S. / Ternopil: Mandrivets, 2011.
21. Collection of tasks for the state final certification in chemistry. Grade 9 / authors Lashevska G.A., Tytarenko N.V. / K: Center for Educational and Methodological Literature, 2011.
22. Collection of tasks for the state final certification in chemistry. Grade 11 / author Dubovik O.A. / K: Center for Educational and Methodological Literature, 2011.
23. Chemistry. Full course. Universal guide for graduates and entrants / author Titarenko N.V. / K: Litera LTD, 2011.

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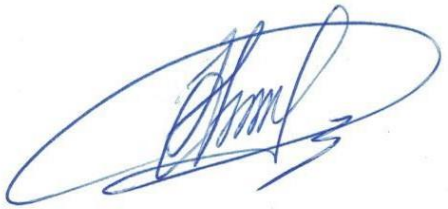

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