



**MINISTRY OF EDUCATION AND SCIENCE OF THE  
REPUBLIC OF KAZAKHSTAN**

**ABAY KAZAKH NATIONAL PEDAGOGICAL  
UNIVERSITY**

**Approved**

At the meeting of the Scientific  
and methodological Council of  
KazNPU. Abai's  
Chairman RMC

Rector \_\_\_\_\_ T. Balykbayev

Protocol № \_\_\_\_ от «\_\_» \_\_\_\_ 2019y

**CATALOGUE OF ELECTIVE DISCIPLINES**

**Specialty 6B01511 Training of teachers in natural sciences (Chemistry)**

**2019/2020 school year**

**INSTITUTE OF NATURAL SCIENCE AND GEOGRAPHY  
DEPARTMENT OF CHEMISTRY**

**Almaty, 2019**

<b>CATALOG OF ELECTIVE DISCIPLINES</b> <b>Bachelor's Level</b> <b>In the specialty "6B01511- Training of teachers in natural science subjects (Chemistry)"</b> <b>2019/2020 academic year</b>		
<b>Cycle of disciplines</b>	<b>Name of disciplines and their main sections</b>	<b>(ECTS)</b>
	<b>SELECTION COMPONENT (SC)</b>	<b>5</b>
	<b>Art education</b>	
	Basic knowledge of the main milestones in the formation and development of Russian art and artistic culture from ancient to modern times. The course covers all kinds of art, which allows to make a General picture of the evolution of the moral and aesthetic world of the Kazakhs, the elements of ritual and their importance for the formation of the image of the modern Kazakhstani.	
<b>2.</b>	<b>Inclusive education</b>	<b>5</b>
	The role of inclusive education in social and educational policy. Legal support, models, forms, types of inclusive education. Psychological and pedagogical problems of teaching and education of children with disabilities in inclusive education. Psychological and pedagogical technologies of work with children with disabilities and their families. Interaction with teachers and psychologists in the organization of inclusive education	
<b>1.</b>	<b>Management in education and electronic documentation</b>	<b>5</b>
	Scientific and methodological bases of pedagogical management. Intra-school management. Regularities and principles of management at school. Functions and methods of pedagogical management. Information technologies in management. Leadership style. Ethics and culture of management. Marketing. The competitiveness of the educational organization. Electronic log book of classes, automatic distribution of classes, completed documents and reports monitoring visits to teachers and students of others.	
<b>3.</b>	<b>Pedagogical measurements</b>	<b>5</b>
	Modern means of evaluation of learning outcomes. The problem of valuation activity. The model of technology based assessment. Principles of evaluation. Stages and tools of evaluation. Criteria table – the subject heading. Formative assessment and summative (internal and external) assessment. Moderation of summative assessment results. Age criteria for the evaluation of educational outcomes. Self-esteem and mutual evaluation with peers. Pedagogical tasks of the portfolio. Functions and composition of the portfolio.	
<b>4</b>	<b>Student teaching</b>	<b>4</b>
	To acquaint students with the activities of teachers-psychologists in various educational organizations. Familiarization with pedagogical and psychological technologies. The study of the psychological climate and relationships in the educational environment. Study and generalization of the experience of honored teachers-psychologists.	
<b>5</b>	<b>Theoretical foundations of inorganic chemistry</b>	<b>6</b>

	Theoretical foundations of inorganic chemistry. Atomic and molecular doctrine, basic stoichiometric laws of chemistry, methods for determining atomic and molecular masses, the structure of the atom, the basic principles of quantum mechanics, quantum numbers, Pauli, Hund and Klechkovsky rules, Periodic law and Periodic system, chemical bonding, valence bond theory, molecular orbital theory, concepts of hybridization of orbitals, molecular structure theory, crystal field theory; solutions, theory of electrolytic dissociations, hydrolysis of salts, redox reactions, basic concepts of the theory of coordination compounds.	
6	<b>Chemistry of elements of the periodic table/</b>	6
	Hydrogen, production, properties, practical application. General characteristics of s-elements. Alkaline, -alkaline earth metals, preparation, properties, important compounds, application. General characteristics of p-elements. Aluminum, carbon, silicon, nitrogen, phosphorus, sulfur, Halogens, preparation, properties, important compounds, application. General characteristics of d-elements. Chromium, manganese, iron, copper, zinc, important compounds, application. f-elements, radioactivity, industrial use in science and technology. Production of metals and their alloys in Kazakhstan.	
7	<b>Qualitative chemical analysis</b>	5
	Theoretical bases of analytical chemistry; classification, types of analyses. Methods of qualitative analysis. Sensitivity of analytical reaction. Minimum definition. The law of the masses. Basic concepts of the theory of electrolytic dissociation. The ionic product of water. The theory of strong electrolytes. Activity. Activity coefficient. Ionic strength of solution. Protolytic theory of acids and bases, calculation of pH solutions. Buffer solution. Application of the law of masses in the hydrolysis process. Amphoteric processes in qualitative analysis. Equilibrium in heterogeneous systems. Solubility. Factors affecting solubility, influence of homogeneous forces. Redox processes. The essence of complex compounds in analytical chemistry. Qualitative analysis of cations. Qualitative anion analysis.	
8	<b>Quantitative methods of analytical chemistry analysis</b>	5
	Principles of quantitative analysis. Classification of quantitative analysis methods. The essence of gravimetric analysis. The essence of titrimetric analysis and its application. Methods of acid-base titration. Methods of redox titration. Deposition method. Complexometric titration.	
9	<b>Organic chemistry of aliphatic compounds</b>	6
	Theoretical foundations and history of organic chemistry; Electronic points of view in the theory of the structure of organic molecules. A series of acyclic hydrocarbons. Alkanes. Alkyls. Alkynes. Alkadienes. Halogen derivatives of hydrocarbons. Haloalkane. Nitro compounds and Amines of alphabetical series. Alkanols (derivatives of hydroxy hydrocarbons, alcohols). Aldehydes and ketones (oxides of hydrocarbons). Monocarboxylic acids. Carboxylic acid derivatives. Dicarboxylic acid. Oxycarboxylic acids.	
10	<b>Organic chemistry of cyclic compounds/ Organic chemistry of cyclic compounds</b>	6
	Carbohydrates. Monosaccharides. Oligosaccharides, polysaccharides. Alicyclic series of hydrocarbons. Aromatic aldehydes and ketones. Aromatic acids. Aromatic amines. Aromatic diazo and azo compounds. Benzene rings are non-condensed multi-core aromatic carbohydrates. Multinuclear aromatic hydrocarbons of condensed benzene rings. Heterocyclic compound. Six-membered and five-membered heterocycles.	

11	<b>Problems in chemistry of increased complexity</b>	<b>3</b>
	<p>Basic concepts of chemistry. World System of Units (SI). Advantages and disadvantages of the SI system. Solving problems using formulas. Determination of the molecular mass of gaseous substances using the Mendeleev-Klaiperon equation. Calculations for the preparation of the solution. Calculation of the mass of the solute. Solving problems in molar, molal, normal concentrations. Solving problems in thermochemical reactions. The speed of a chemical reaction.</p> <p>Carbohydrates. Monosaccharides. Oligosaccharides, polysaccharides. Alicyclic series of hydrocarbons. Aromatic aldehydes and ketones. Aromatic acids. Aromatic amines. Aromatic diazo and azo compounds. Benzene rings are non-condensed multi-core aromatic carbohydrates. Multicore aromatic hydrocarbons of condensed benzene rings. Heterocyclic compound. Six-membered and five-membered heterocycles.</p>	
	<b>ELECTIVE COMPONENT (EC)</b>	
4	<b>Chemical technology</b>	<b>4</b>
	Chemical technology. Production processing of inorganic substances. Raw materials, energy, water. Problems of nature protection. Sulphuric acid production. Ammonia synthesis. Nitric acid production. Electrochemical and electrothermal production. Production of iron and steel. Fuel treatment. Basic organic synthesis. Oil processing. Chemical fiber. Polymer production	
5	<b>Computer chemistry</b>	<b>3</b>
	Information technologies in chemistry. Computer engineering: application in chemistry, history of development. The device is a personal computer. Personal computer software. Computer network. Search, storage and data protection. Text data. Graphic data. Graphic data. Data base. The implementation of the database. The concept of databases. Introduction to Microsoft Access. Database management. The order of data placement. Savings Fund used in the chemical industry.	
6	<b>Bioorganic chemistry</b>	<b>3</b>
	The main important for the life of the body biological compounds: amino acids, proteins and peptides, nucleotides, nucleic acids, carbohydrates, lipids, coenzymes. Energy metabolism. ATP, methods of ATP synthesis. Mono-functional bio-organic compounds: alcohols, aldehydes, ketones. Classification. Development. Objects of research of Bioorganic chemistry. Functional groups, and the homologs of Bioorganic compounds. Biopolymers and their structural components. Low molecular weight bioregulators. Types of Bioorganic reactions.	
7	<b>Geochemistry</b>	<b>3</b>
	Formation of geochemical science, methods of analysis. The main goals and objectives of Geochemistry. The modern model of the Earth. Geochemical barriers and their influence on the formation of ore deposits. Geochemical classification of elements. Geochemistry of hydrosphere, chemical composition of sea waters. Distribution of minerals in the Earth's crust. Biological absorption of chemical elements. The influence of organisms on the accumulation of chemical elements. Geochemical circulation of the main gases of the earth's atmosphere. Geochemical methods for determination of minerals. Geochemistry of hydrothermal processes. Types of chemical bonds in minerals.	
8	<b>Chemical ecology</b>	<b>4</b>
	Fundamentals of chemical ecology and environmental problems. Basic concepts and criteria for the study of matter. Chemical bases of transformation of pollutants in natural environments. Ecology of organic compounds. Radioactive contamination. Chemical ecology of the atmosphere. Chemical components of	

	the atmosphere. Chemical ecology of hydrosphere. Heavy metal. Chemical ecology of the lithosphere. Biogeochemical cycle. Technology of industrial wastewater treatment. Ecology and energy. Environmental monitoring.	
9	<b>Physical chemistry</b>	<b>4</b>
	Basic concepts of thermodynamics. Thermodynamic theory of solutions. Thermodynamic properties of ideal solutions. Solid - liquid equilibrium of the solution. Formal kinetics. Theories of chemical kinetics. Simple and complex reactions. The effect of temperature on the reaction rate. Activation energy. Catalysis. Homogeneous, heterogeneous catalysis. Electrochemistry. Electrolyte solutions. Electrical conductivity of electrolyte solutions. Electrochemical circuits (galvanic cells).	
10	<b>Colloid chemistry</b>	<b>4</b>
	The main stages of development of colloid chemistry. Classification and nature of disperse systems. Molecular-kinetic and rheological properties of colloidal systems. Optical properties of colloidal systems. Surface phenomenon. Surface activity. Duclos-Traube Rules. Adsorption at the boundary of liquid-gas and liquid-liquid separation. Adsorption in solid adsorbent. Electrokinetic phenomena. Methods of preparation and purification of colloidal solution. Stability and coagulation of the colloid system. Coagulation of hydrophobic sols. Coagulation under the action of electrolytes. Schulze-Guardi Rules. Separate classes of colloidal systems. Surface-active substances (surfactants) classification and General characteristics. Microheterogeneous system. Aerosols. Powders. Semi-colloids. Soap. Suspension. Emulsion. Foams.	
11	<b>Macromolecular chemistry</b>	<b>3</b>
	Basic concepts of macromolecular compounds. Nomenclature of polymers and types of polymers. Polymer properties. Isomerism of conformational and configurational macromolecules. Flexible properties of the polymer chain. The nature of polymer solutions.	
12	<b>Chemical synthesis</b>	<b>4</b>
	Reactions of nucleophilic substitution of aliphatic series. Nucleophilic substitution in alkyl halides. Nucleophilic substitution of hydroxyl subgroup in alcohols: reactions of carboxylic acid with nucleophilic reagents and its derivatives (anhydrides, anhydrides halogen). The esterification reaction. Hydrolysis of esters. Substitution reactions of aromatic compounds. Diazo-coupling reactions. Oxidation-reduction reactions. Laboratory methods for obtaining inorganic compounds. Typical methods for obtaining inorganic compounds.	
13	<b>Organization of scientific activity of schoolchildren</b>	<b>3</b>
	Methods of scientific research. Choice of research direction. The choice of research direction and stages of research work. Methodical bases of scientific knowledge and creativity. General scheme of scientific research. The choice of research direction and stages of research work. Search, collection and processing of scientific data. Experimental study. Processing of experimental results.	