



**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 6B05301 - Physical and Chemical Sciences (Chemistry)

2019/2020 school year

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

Almaty, 2019

CATALOG OF ELECTIVE DISCIPLINES Bachelor's Level In the specialty 6B05301 - Physical and Chemical Sciences (Chemistry) 2019/2020 academic year		
Cycle of disciplines	Name of disciplines and their main sections	(ECTS)
SC 1.2	SELECTION COMPONENT (SC)	5
	Basis of the economy and business	
	Social production. The essence, form, structure of capital. Production costs. Production incomes in a market economy. Business concept. Types of business activities. Theory of ownership, social forms of management. Goods, money. Social and economic system. The emergence of the market. Financial system. The role of the state in business development. Macroeconomics. Resource Saving. Cyclical economic development. Inflation and unemployment. Kazakhstan in the system of world economic relations.	
	Bases of the law and anti-corruption culture	
	Fundamentals of law and anti-corruption culture The main provisions of the Constitution, the current legislation of the Republic of Kazakhstan; the system of government, the terms of reference, goals, methods of state regulation of the economy, the role of the public sector in the economy; financial law and finance; mechanism of interaction of substantive and procedural law; the nature of corruption, the reasons for its origin; measure of moral, legal responsibility for corruption offenses; current anti-corruption legislation	
	Health and safety of the person	
	Life safety, its main provisions. Hazards, emergency situations. Risk analysis, risk management. Human security systems. Destabilizing factors of our time. Social dangers, protection from them: dangers in the spiritual sphere, politics, protection from them: dangers in the economic sphere, dangers in everyday life, everyday life. The system of bodies ensuring life safety, and legal regulation of their activities	
	Ecology and sustainable development	
	The main laws governing the functioning of living organisms, ecosystems of various levels of organization, the biosphere as a whole, and their stability; the interaction of the components of the biosphere and the environmental consequences of human activities, especially in conditions of intensification of environmental management; modern ideas about the concepts, strategies and practical tasks of sustainable development in various countries and Kazakhstan; problems of ecology, environmental protection, sustainable development	
5	Inorganic synthesis	6
	Synthesis of inorganic and coordinating substances. Basic methods of purification, concentration and separation of inorganic substances. Reactions in the gas phase. Synthesis of anhydrous inorganic compounds. Obtaining simple substances, oxides, halogens, hydrides, hydroxides, acids and salts. Physico-chemical methods of purification of synthesized substances. Modern methods of synthesis of inorganic substances and materials.	

	Chemistry of high-molecular compounds	
	Basic principles of high molecular weight conjugation. Nomenclature of polymers and polymers. The properties of polymers. Isomeres of conformational and configurational macromolecules. Fibrous polymeric chain. Primer of polymer solvents.	
	Chemical kinetics and electrochemistry	
	Basic concepts of thermodynamics. Thermodynamic theory of solutions. Thermodynamic properties of ideal liquid solutions. Equilibrium in solid-liquid systems. Theories of chemical kinetics. Simple and complex reactions. Influence of temperature on reaction rate. Activation energy. Catalysis. Homogeneous, heterogeneous catalysis. Electrochemistry. Electrolyte solutions. Electric conductivity of electrolyte solutions. Electrochemical Circuits (Galvanic Cells).	
	Chemistry of biologically active substances	
	The main biological compounds that are important for the life of the body: amino acids, proteins and peptides, nucleotides, nucleic acids, carbohydrates, lipids, coenzymes. Energy exchange. ATP, methods for the synthesis of ATP. Monofunctional bioorganic compounds: alcohols, aldehydes, ketones. Classification. Development. Objects of bioorganic chemistry research. Functional groups and homologs of bioorganic compounds. Biopolymers and their structural components. Low molecular weight bioregulators. Types of bioorganic reactions.	
6	Solving advanced tasks	6
	Basic concepts of chemistry. Worldwide (CI) Units System. Advantages and disadvantages of the SI system. Reports using formulas. Determination of the molecular weight of gaseous substances using the Mendeleeva-Clapper equation. Solutions for the preparation of solutions. Calculation of the mass fraction of dissolved matter. The production of molecular, molecular, normal concentrations. Reports on thermochemical reactions. Speed of chemical reaction.	
7	Physical research methods	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.	
8	Recycling of chemical products	5
	Chemical industry, environmental threats. Classification of chemical industry wastes. Chemical waste sources: pharmaceuticals, cosmetic industries, petrochemicals, metallurgical, electrochemical plants, rubber and eletermin sites, household chemistry and fertilizer production facilities, megachildren, research laboratories, etc. Peculiarities of processing of chemical products, types: neutralization, chlorination by oxidation, thermal method, method of distillation, biological method. Recycling of expired chemical reagents. Polymer processing. Responsibility for wrong work with chemical waste	
	Chemistry teaching methods	
	The purpose of the discipline "Methods of Teaching Chemistry" is to provide students with knowledge of the theoretical and methodological foundations of methodological science and initial methodological skills that ensure the performance of various functions of a teacher of Chemistry. The subject and	

	problems of teaching chemistry. Chemistry Learning Objectives. The structure and content of Chemistry at school. Classification of teaching methods Chemistry. Description of the main forms of extracurricular activities.	
	Chemical ecology	
	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.	
	Structure of substances	
	Chemical bonding. Molecule geometry. Molecules symmetry. Elementary properties of molecules. The magnetic field of the molecules. Average energy properties of molecules. The state of the electron vibration in the molecule. Variable state. Rotation, vibration and electronic spectra of molecules. Molecular interaction. The structure of the molecule in space. The method of molecular orbital. Order and energy of connections. Electronic configuration of molecules.	
	Computer chemistry	
	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.	
	History of Chemistry	
	Subject and general tasks of chemistry history. The Importance of Chemistry History. Stages of development of chemical science. Chemistry as a science. The period before alchemy. The period of alchemy. Hydrochemistry and technical chemistry. Period of formation. Experimental Natural Science in the XVII century. Formation of the theory of chemical elements. A new stream of chemistry. Works by R. Boyle and his contemporaries. The Stoichiometric Chemistry Period of Chemistry. Classical chemistry. Periodicity of elements. The first steps of planning. The history of the discovery of periodic chemical elements. Periodic law and periodic table of Mendeleev. Stage of structural chemistry. Physical chemistry. Chemistry of the XX century. Atomic model. Modern chemistry. Nanotechnology	
	Water and food analysis	
	Chemical, physical properties of water. Water molecule. Water is an essential element of the biosphere. Hydrosphere. Cryosphere. Chemical compounds in drinking water. Harmless concentrations of chemical compounds and elements in drinking water. Water analysis. Water purification. Mechanical, chemical, physico-chemical and biological methods of water treatment. Chemistry and plants. Half measures in crop production. Fertilizers Pesticides Pheromones and chemical mutants. Chemistry and livestock. The role of chemistry in animal husbandry. Squirrels. Fats. Sugar or carbohydrates. From a chemical point of view, nutrients can be divided into three types. Biochemical changes. Vitamins, salts, trace elements in the diet. Avitaminosis. Salts needed by man. Microbiogenic elements. Enzymes	

9	Solving problems in inorganic chemistry	6
	Guidelines for the correct application in chemistry of names, signs and definitions of physical quantities and their units. Mass, relative atomic mass, molar mass of atoms and molecules. The simplest formulas. Gas laws. Avogadro's Law. Determination of the molecular mass of gaseous substances according to Clapeyron-Mendeleev. Definition of the imperial formula of ionic compounds. Calculation of the mass part of the solute. Determination of the mass of soluble and dissolved substances through a certain mass fraction of solute. Calculations to determine the concentration of solutions. Molar concentration, molar equivalent concentration (normal concentration), tasks on the molar concentration of the solute.	
10	Fundamentals of scientific research in chemistry	6
	Methodology of scientific research. The choice of research direction. The choice of the direction of scientific research and the stages of research work. Methodological foundations of scientific knowledge and creativity. The general scheme of scientific research. The choice of the direction of scientific research and the stages of research work. Search, collection and processing of scientific data. Experimental study. Processing the results of experimental studies	
11	Organic synthesis	3
	Reactions of nucleophilic substitution of aliphatic series. Nucleophilic substitution in alkyl halides. Nucleophilic substitution of a hydroxyl subgroup in alcohols: reactions of a carboxylic acid with nucleophilic reagents and its derivatives (anhydrides, halogen anhydrides). Etherification reactions. Hydrolysis of esters. Substitution reactions of aromatic compounds. Diazocompounds reactions. Redox reactions.	
	Petrochemistry	
4	Petroleum products and their use. Composition and properties of oil and natural gases. The origin of oil and natural gases. Primary processing of associated gases. Purification of oil from water and solid impurities. Cracking oil. Physicochemical principles of thermal cracking. The optimal state of thermal cracking. Physicochemical fundamentals of catalytic cracking. Optimal conditions for the formation of aromatic hydrocarbons. Cyclohexane production. Physicochemical fundamentals of hydrogenation of petroleum products. The optimal state of hydrocracking. Hydrolytic refining of petroleum products. The main processes of processing products from oil and natural gas.	4
	Physical chemistry of polymers	
5	Classification, nomenclature of polymers. Features of the polymer state of the substance. Conformational and configurational isomerism of a macromolecule. Flexible properties of the polymer chain. The nature of polymer solutions. Methods for determining the molecular weight of polymers. Properties of ionizing macromolecules (polyelectrolytes). Polymer synthesis methods. Radical polymerization. Methods of radical copolymerization. The kinetics of cationic and anionic polymerization, the mechanism of ion coordination polymers. Polycondensation methods. Chemical conversion reactions of polymers.	3