

AL-FARABI KAZAKH NATIONAL UNIVERSITY

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Approved at the meeting of
Academic Committee of the University
Protocol # _____, "____" _____ 2022

6B05 Natural sciences, mathematics and statistics

6B053 Physical and chemical sciences

6B05301 – Chemistry

Almaty, 2022 y

**PASSPORT
OF EDUCATIONAL PROGRAM**

6B05301-CHEMISTRY

1. General characteristics of the educational program	
Registration number	
Code and classification of the field of education	6B05 Natural sciences, mathematics and statistics
Code and classification of educational areas	6B053 Physical and chemical sciences
Name of educational programs	6B05301 Chemistry
Availability of application for license for the direction of personnel training	№ 0137355 since 03.02.2010
1.1 EP mission	<p>Training of personnel with fundamental knowledge and professional competencies for carrying out professional activities in various fields of chemistry and related industries:</p> <ul style="list-style-type: none"> - field of scientific research; - the sphere of creating new types of chemical products and materials, improving and optimizing technologies of their production for the needs of industry and agriculture; - the sphere of quality control, standardization and certification of raw materials and chemical products; - the sphere of basic, secondary and vocational education. <p>Upon completion of the educational program, the bachelor will be able to solve theoretical and applied tasks in the following areas of chemistry:</p> <ul style="list-style-type: none"> - theoretical and applied chemistry; - chemical examination; - green chemistry; - nanochemistry and nanomaterials; - receipt and design of materials.
1.2 Key indicators of educational program	<p>Type of educational program: Bachelor Terms of educational program: 4 years Forms of education: full-time Labor input: 240 academic credits Awarded degree: Bachelor of Natural Science on educational programs «Chemistry» Acting EP</p>

<p>1.3 Description of the advantages and distinctive features of the educational program in terms of positioning in the market of educational services</p>	<p>Distinctive features of educational program: Presence of accreditation of educational program: International accreditation ASSIN Name of accreditation body: agency Duration of accreditation: 30.09.2022 According to the rating of educational programs among universities of the Republic of Kazakhstan takes the place: IAAR - 1 IQAA - 2</p> <p>There are 3 research institutes for the implementation of the educational program at the Faculty of Chemistry and Chemical Technology: the Center of Physical and Chemical Research and Analysis Methods, the Research Institute of Combustion Problems, the Research Institute of New Chemical Technologies and Materials, and the laboratories of the Analytical and Colloidal Chemistry and rare elements Technology Department, laboratories of the department of chemistry and technology of organic substances, natural compounds and polymers, laboratories of the department of physical chemistry, catalysis and petro chemistry, laboratories of the department of chemical physics.</p> <p>Practice bases:</p> <p>Bases of professional types of practices: JSC NAK “Kazatomprom”, Pavlodar Chemical Plant, Aktyubinsk Plant of Chromium Compounds, “Kazphosphate” LLP, “Institute of Combustion” Problems RSE, “In Prometheus” LLP, “Жайна” LLP, “Zhalyn” LLP, “Karachaganak Petroleum Operating”, Pavlodar Chemical Plant, Pavlodar Petrochemical Plant, Pavlodar Pharmaceutical Plant, “Nobil Farm” Almaty, “Membrane Technologies” LLP, “Kazmunaygas” JSC, “ORGANIC” Oil Products Independent Center for Expertise of Petroleum Products LLP, “Food Master” LLP, Pavlodar Petrochemical Plant LLP, “KazMunayGas” JSC, United Chemical Company LLP, “Kazphosphate” LLP, “Agrochemistry” LLP, “Kazakhmys Corporation” LLP, KazNII Plant Protection and Quarantine LLP, “Coca-Cola Almaty Bottlers” JV LLP, KazSRI “U.Uspanova named Soil Science and Agrochemistry” LLP”, Institute of Forensic Examination of the Central Federal Agency for Economic Development of the Ministry of Education of the Republic of Kazakhstan, the National Center for the Evaluation of Medicinal Products and Medical Devices and Medical Equipment, JSC “Nazarbayev Intellectual Schools”, professional schools, colleges, universities and research institutes of chemical profile.</p> <p>Staff potential: The teaching staff includes 8 doctors of science, 11 candidates of science and 8 doctors of Ph.D; Scientific schools or scientific directions of the department (scientific projects)</p> <ul style="list-style-type: none"> - radioecological investigations of territories contaminated by man-made and natural radionuclides - fundamental research of electrode processes in multi-component systems involving non-ferrous and rare metals, - development of new methods of analysis and production of substances and materials from mineral and vegetable raw materials of Kazakhstan; - extraction and sorption methods of concentration, extraction and separation of rare and noble metals; - environmental monitoring of the territories of the Republic of Kazakhstan exposed to rocket and space activity and polluted by oil and oil products;
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- creation of a system analytical control (certification) of products of various industries, agriculture and environmental objects;
- colloidal chemistry of water-soluble polymers and their associates with surfactants;
- development of scientific foundations for creating new composite materials with desired properties (emulsifiers, frothers, structure formers);
- colloidal chemistry of biological and food disperse systems;
- new directions in the synthesis of biologically and surface-active heteroatomic cyclic structures based on products of deep processing of hydrocarbon raw materials;
- development of rational, high-tech, economically and environmentally justified methods for the synthesis of new organic substances with desired properties;
- development of biomedical polymers;
- macromolecular design and functioning of stimulus-sensitive polymers;
- chemistry and physics of composite polymeric materials;
- creation of new highly effective medicines of a wide spectrum of action (ointment, syrup, capsules, suppositories) on the basis of plant substances;
- standardization of soft and solid dosage forms, created on the basis of a substance of plant origin;
- physical-chemical basis for obtaining multifunctional biomedical materials (nanofilms) with antibacterial and anti-inflammatory properties;
- complex thermal processing of oil shale and coal;
- hydrogenation processing of distillate fractions of coal tar semi-coking of coal from the Shubarkol deposit to obtain non-sulphurous naphthalene, benzene and tetralin;
- development of technology for low-sulfur diesel fuel from coal distillates using hydrogenation processes.

Comparison with similar programs of foreign universities

The "6B05301 – Chemistry" program adheres to the methodology of providing high quality bachelor of higher professional education with social mobility, competitiveness and sustainability in the modern labor market. The program "6B05301 – Chemistry" is fully consistent in its structure and content with the programs of M.V. Lomonosov Moscow State University (position in rating QS - 90) and foreign universities: University of Michigan (QS-20), Stanford University (QS-2), Peking University (QS-30), California Institute of Technology (Caltech) (QS-4).

2. Qualification requirements in the format of learning outcomes (results of education)

<p>2.1 Expected learning outcomes (results of education) of Educational program</p>	<p>At the end of the course students should be able to:</p> <p>LO1 - formulate modern ideas about the main directions of development of chemistry as a science, the basic principles, laws and theories of its fundamental sections;</p> <p>LO2 - classify physical and physico-chemical methods for studying the properties of substances and processes; methods to synthesize and obtain chemicals and materials;</p> <p>LO3 - demonstrate an understanding of the dependence of the reactivity of substances on the structure of molecules, the nature of the chemical bond, the composition of the system and conditions of the chemical reaction; of regularities of physical and chemical processes from the point of view of modern achievements of theoretical and applied chemistry;</p> <p>LO4 - solve standard tasks of professional activity using knowledge of theoretical and applied bases of chemistry and fundamental concepts of other natural, social sciences and humanities courses;</p> <p>LO5 - substantiate the use of synthetic and analytical methods for study the properties of substances, parameters and regularities of physico-chemical processes;</p> <p>LO6 - calculate and estimate the basic thermodynamic, kinetic parameters of various physicochemical systems and processes, including using modern computing technology;</p> <p>LO7 - predict the possibility, direction and depth of the chemical process in order to obtain the product with desired characteristics and to increase its output based on the calculated and experimental data on the properties of substances and process parameters;</p> <p>LO8 - analyze the reasons for deviation of process parameters, including technological, in order to make decisions on their prevention and correction;</p> <p>LO9 - plan, organize and conduct a scientific experiment or test involving physical, chemical and mathematical methods, followed by processing the obtained results;</p> <p>LO10 - substantiate the choice of a mathematical model, the most efficient method of synthesis, analysis and measuring instruments to solve specific research or production task;</p> <p>LO11 - to conduct a critical analysis and systematization of the results of a study or test with the subsequent presentation of materials in the form of scientific reports, publications, presentations;</p> <p>LO12 - evaluate the state of systems and processes in order to improve, develop and implement methods, approaches, technologies and measures aimed at reducing environmental pollution, improving the rational use of natural resources, safety and environmental friendliness of products and technologies.</p> <p>LO 13 - To apply in professional and social life for successful personal growth the scientific and philosophical heritage of al-Farabi and Abay, administrative and legal norms in the field of combating corruption, patterns of interaction between living organisms and the environment</p>
<p align="center">2.2 Expected results for each module of educational program (in accordance with the Guidelines for the description of learning outcomes).</p>	

<p>2.2.1. Module of social and cultural development</p>	<p>Upon successful completion of this module, the student should be able to:</p> <ul style="list-style-type: none"> - explain and interpret subject knowledge (concepts, ideas, theories) in all fields of science that form the academic disciplines of the module (sociology, political science, cultural studies, psychology); - classify the methods of scientific and philosophical knowledge of the world; - algorithmized to represent the use of scientific methods and research techniques in the context of a particular academic discipline and in the procedures for interaction between the disciplines of the module; - distinguish between strategies of different types of research in society and justify the choice of methodology for analyzing specific problems; - substantiate and explain the historical background and periods of the formation of an independent Kazakhstani statehood in the context of the world and Eurasian historical process. - conduct a critical-comparative and retrospective analysis of individual phenomena and events of the historical past with a common paradigm of the world-historical development of human society based on the new positions of modern Kazakhstan. - substantiate the role and importance of key worldview concepts as values of social and personal being of a person in the modern world; - conduct research relevant to identifying the content (historical, philosophical and other) of problems in the professional field and to present the results for discussion.
<p>2.2.2. Instrumental module</p>	<p>Upon successful completion of this module, the student should be able to:</p> <ul style="list-style-type: none"> - explain the purpose, content and trends of information and communication technologies, - describe the architecture of computer systems and networks, the purpose and function of the main components; - use Internet information resources, cloud and mobile services for search, storage, processing and dissemination of information; - use software and hardware of computer systems and networks for data collection, transmission, processing and storage; - to interpret the text information, explain the stylistic and genre specificity of the texts of the socio-cultural, socio-political, official business and professional areas of communication in the scope of certification requirements; - read, translate and understand authentic texts of a foreign language into the native language using dictionaries and reference books, as well as software and hardware; - communicate on a variety of general and educational and professional topics; - to request and report information in accordance with the situation of communication, evaluate the actions of participants, use information as a tool to influence the interlocutor in situations of knowledge and communication in accordance with certification requirements.

<p>2.2.3. Module Physical Training</p>	<p>Upon successful completion of this module, the student should be able to:</p> <ul style="list-style-type: none"> - know the rules of safety and health; - understand the role of physical culture in human development and specialist training; - be able to perform basic training exercises; - know the basics of physical culture and a healthy lifestyle; - know the anatomical features of a person, his physiological structure; - possess a system of practical skills and abilities ensuring the preservation and strengthening of health, the development and improvement of psychophysical abilities and qualities (with the fulfillment of the established standards for general physical and sports-technical training); - gain personal experience in the use of physical culture and sports activities to enhance their functional and motor abilities, to achieve personal life and professional goals; - own the means of independent, methodically correct use of methods of physical education.
<p>2.2.4 Общая химия и математика</p>	<p>Upon successful completion of this module, the student should be able to:</p> <ul style="list-style-type: none"> - formulate the basic fundamental concepts of mathematics, fundamental sections of general chemistry and inorganic chemistry; - demonstrate knowledge and skills in building a mathematical model of the process under study, in choosing methods for solving a problem; - to analyze, put forward a hypothesis, choose the most accurately describing the laws of distribution of the studied quantities; - use mathematical methods to solve professional problems; - predict the properties of chemical elements and their compounds based on the periodic law and the structure of the atom; - apply Le Chatelier's principle to chemical equilibria; - to use scientific, reference, methodological literature, statistical data for the preparation of a report on practice and the implementation of the CDS; - classify chemical methods for obtaining and studying the properties of inorganic substances; - analyze the relationship between the composition, structure and properties of simple substances and their compounds, methods for obtaining inorganic substances and their application.

<p>2.2.5. Physics and physical chemistry</p> <p>-</p>	<p>Upon successful completion of this module, the student should be able to:</p> <ul style="list-style-type: none"> - demonstrate knowledge and understanding of the laws of physics, chemical thermodynamics, kinetics, catalysis and electrochemistry; - describe the main thermodynamic patterns of the flow of physical and physico-chemical processes; - calculate kinetic and thermodynamic parameters of physical and chemical processes; - independently conduct a physical and chemical experiment, analyze and interpret the results obtained and draw conclusions; - use the acquired knowledge in the field of physical chemistry in the study of other disciplines, as well as in further research and practical activities; - choose the optimal conditions for the experiment using thermodynamic and kinetic laws; - to substantiate and predict the direction, output and speed of chemical processes based on the obtained thermodynamic and kinetic characteristics of various processes; - apply the theoretical foundations of physical chemistry to solve practical problems.
<p>2.2.6 Inorganic and organic chemistry</p>	<p>Upon successful completion of this module, the student should be able to:</p> <ul style="list-style-type: none"> - characterize the theoretical foundations of inorganic and organic chemistry; - describe the chemical and physical properties of inorganic and organic molecules depending on the molecular composition, electronic structure and type of hybridization, the nature of the functional group; - demonstrate knowledge about the features of the chemical properties of compounds depending on the structure and scope; - analyze the electronic structure of inorganic and organic compounds; - suggest ways to solve problems in the process of obtaining inorganic and organic molecules; - substantiate the main patterns that occur when functional groups of various nature are introduced into a hydrocarbon bond; - analyze the features of the influence of the nature of the functional group on the mechanisms of their transformation; - to determine the physico-chemical characteristics of systems by various methods; - to carry out the receipt, purification, isolation of substances from various systems.

2.2.7 Analytical chemistry	<p>Upon successful completion of this module, the student should be able to:</p> <ul style="list-style-type: none"> - substantiate the basic concepts of analytical chemistry: analytical reaction and analytical signal; - explain the classification of physical methods of analysis, their essence, technical means of performing the analysis; - explain the mechanisms and principles of generating an analytical signal related to the individual chemical properties of the substances being determined; - calculate the parameters of simple and complex ionic equilibria in solutions to select the optimal analysis conditions; to calculate the results of gravimetric and titrimetric analysis; - master the basic methods of work in the chemical analytical laboratory, including operations of titration, weighing, sedimentation, filtration, extraction, sample preparation; - decipher analytical signals received manually or by means of the corresponding software, to interpret the received information; - carry out the analysis using standard analytical chemistry techniques widely used in modern practice; own work methods on the main types of analytical equipment; <p>know the methodology of choice of methods and methods of analysis, understanding the possibilities of various methods in relation to the analysis of real objects, as well as correctly formulate the formulation of the analytical problem.</p>
2.2.8 Structure of matter and physical research methods	<p>Upon successful completion of this module, the student should be able to:</p> <ul style="list-style-type: none"> - to formulate modern ideas about the main directions of development of the doctrines of the structure of matter and the mechanism of reactions; - explain the dependence of the reactivity of substances on the structure and structure of molecules, the nature of the chemical bond, the state of aggregation of the substance; - to predict the properties of the obtained compounds based on knowledge of the structure and structure of molecules, the nature of the chemical bond, the mechanism and chemistry of the process; - use group theory to classify vibrational rotational states and determine allowed transitions; - analyze the possibilities of using symmetry to describe the types of terms of complex molecules, molecular spectroscopy; - evaluate the possibility of applying the most probable direction of chemical transformations of molecular systems using symmetry.
2.2.9 Metrology and standardization in chemistry	<p>Upon successful completion of this module, the student should be able to:</p> <ul style="list-style-type: none"> - demonstrate knowledge of the purpose and methods of metrology and standardization; - use statistical methods for processing the results of a chemical experiment; - to carry out a comparison of the main parameters of the sample based on a statistical analysis of the measurement results; - to select a measuring instrument and modeling methods for setting up an experiment based on an analysis and comparison of the main characteristics of the SI; - apply the existing metrological methods for analyzing the accuracy of measurements; - use the basic methods and principles of standardization to determine the quality of reagents and chemical measurements; - analyzes the effectiveness of methods for calculating the economic efficiency of work on certification and metrology.

<p>2.2.10 Physico-chemical systems and its modelling</p>	<p>Upon successful completion of this module, the student should be able to:</p> <ul style="list-style-type: none"> -explain the basic concepts and classification of processes in biochemical systems; - describe the types of processes in solids and biochemical systems, their chemical and physico-chemical properties; - describe the main stages of mathematical modeling and approaches to the construction of the simplest mathematical models; - to select the most effective means and methods for performing measurements; - apply knowledge about the main stages of research and their sequence for planning the experiment; - evaluate the possibility of creating new solid-phase materials with predetermined properties; - interpret the theoretical foundations of mathematical modeling of chemical processes, as well as the basics of working on MATLAB; -use mathematical modeling methods to describe kinetic models of chemical reactions, consisting of one or two equations and chemical reactors.
<p>2.2.10 Modelling in chemistry</p>	<p>Upon successful completion of this module, the student should be able to:</p> <ul style="list-style-type: none"> - identify biologically important organic compounds, based on knowledge of chemical properties and basic methods for studying compounds; - evaluate the mechanical properties of biopolymers in order to select the optimal type of polymerization for a given monomer and evaluate the composition of the final polymer after chemical reactions; - substantiate the properties of bioorganic compounds and their behavior in specific conditions of use, the environment and a living organism; - reproduce possible ways and conditions for the transformation of functional groups in the most important classes of bioorganic compounds in the process of metabolism; - choose the optimal schemes for the synthesis of given biologically active organic compounds; choose rational approaches to the identification and establishment of the structure of organic compounds based on chemical and physico-chemical methods in medicine; - characterize the theoretical foundations of mathematical modeling of chemical processes; - organize a simple educational and research chemical experiment based on mastering the basic techniques of working in the laboratory.
<p>2.2.11 Basis of Chemical Technology</p>	<p>Upon successful completion of this module, the student should be able to:</p> <ul style="list-style-type: none"> - describe the physical and chemical laws of chemical technology, schematic diagrams of instruments or equipment of the corresponding physical research method; - to analyze the theoretical patterns underlying the physical methods of analysis, as well as the principles and areas of their use in technology; - analyze and justify the optimal parameters of technological processes; - evaluate raw materials, energy resources and ways of their rational and integrated use - explain the colloidal state of substances; - determine the physicochemical characteristics of colloidal systems by various methods; - prepare stabile colloidal systems;; - apply the theoretical basis of colloid chemistry for solving the practical problems

<p>2.2.12 Chemical physics</p>	<p>Upon successful completion of this module, the student should be able to:</p> <ul style="list-style-type: none"> - to analyze the theoretical patterns underlying the physical methods of analysis, as well as the principles and areas of their use; - apply the necessary physical method to solve a specific practical problem; - to evaluate and interpret the spectra obtained as a result of the research; - explain the most important processes underlying chemical production; - analyze and justify the optimal parameters of technological processes; - make material and energy calculations of technological indicators of chemical production; - evaluate raw materials, energy resources and ways of their rational and integrated use.
<p>2.2.13. Chemical Expertise</p>	<p>Upon successful completion of this module, the student should be able to:</p> <ul style="list-style-type: none"> - classify the methods used for chemical expertise and control; - demonstrate the ability to apply the methods of conducting chemical expertise; - systematize the physico-chemical properties, composition, structure, consumer characteristics of the examination objects; - carry out sampling and sample preparation of environmental objects (OOS) for analysis; - to make and justify the scheme of expertise and analysis; - interpret the results of the analysis taking into account the metrological characteristics of used methods; - use experimental skills for conducting expert research and documenting the results obtained; <p>interpret the regulatory and legal base of standardization and certification spaces.</p>
<p>2.2.13 Theoretical and Applied Chemistry</p>	<p>Upon successful completion of this module, the student should be able to:</p> <ul style="list-style-type: none"> - analyze modern trends in solving applied problems of radiochemistry, the applicability of new electrochemical technologies to existing industries in Kazakhstan; - use the basic laws, definitions of electrochemistry, the main aspects of industrial technologies based on electrochemical transformations; - analyze the kinetic features of chemical and electrochemical processes; choose methods suitable for specific conditions, the main and auxiliary equipment; - choose the necessary methods for studying nanomaterials, based on the objectives of a particular study; - to analyze the physical principles of construction and operation of equipment for diagnosing nanomaterials.

2.2.13. Green Chemistry	<p>Upon successful completion of this module, the student should be able to:</p> <ul style="list-style-type: none"> - describe the most important principles and directions of development of "green chemistry"; modern strategies for the development of global industry and the programs of chemical producers aimed at preserving environment and achieving sustainable development of society; - classify the main approaches and techniques for carrying out "green" chemical synthesis; technological aspects of implementation and hardware design of "green" chemical processes; prospects for the use of renewable energy sources and their contribution to the global energy production; - understand the principles of green analytical chemistry and use them to formulate and solve various problems; - demonstrate modern theoretical concepts of chemistry and methods of their application to the description and analysis of chemical processes in various natural environments; - analyze the existing methods of experiment and technology for obtaining chemical and nanochemical substances from the point of view of their safety for the environment and humans; - analyze the existing methods of experiment and technology for producing chemicals from the point of view of their safety for the environment and humans; apply modern information technologies in solving practical problems in the implementation of "green" chemical processes; <p>substantiate theoretically the basis of a strategy for cleaner production and "green" chemistry;</p>
2.2.13 Macro and microchemistry	<p>Upon successful completion of this module, the student should be able to:</p> <ul style="list-style-type: none"> - demonstrate knowledge of the chemistry of polymeric materials, petrochemistry, physical chemistry of surfactants, - to argue and substantiate the mechanisms of formation of systems, complex reactions, the principle of action; - explain the nature of chemical bonds in compounds; - determine the parameters of processes; - analyze modern trends in solving applied problems of petrochemistry, the applicability of new technologies to existing industries in Kazakhstan. - use the basic laws, definitions of chemistry of surfactants, the main aspects of industrial technologies based on chemical transformations. - analyze the features of chemical processes; - choose methods suitable for specific conditions, basic and auxiliary equipment; - present the results of scientific research.

2.2.13 Nanochemistry	<p>Upon successful completion of this module, the student should be able to:</p> <ul style="list-style-type: none"> - interpret the main types and properties of nanomaterials, the main directions in nanotechnology; - demonstrate an understanding of the principles of manipulation at the atomic-molecular level in order to change or control the properties of objects, regardless of their size and properties; - to substantiate the classification of nanomaterials by geometric dimension, functional purpose, by the nature of the constituent components; - choose the necessary methods for studying nanomaterials, based on the objectives of a particular study; - analyze the production technology, geometric, electronic structure and reactivity of nanomaterials; - to analyze the physical principles of construction and operation of equipment for diagnosing nanomaterials; - choose methods for analyzing the elemental composition, structure and geometric parameters of nanosized particles and materials; -conduct experimental studies on analysis and control материалов и КОМПОНЕНТОВ НАНО- и МИКРОСИСТЕМНОЙ ТЕХНИКИ.
3. Areas of graduate professional activity	
3.1 Planned areas of graduate professional activity.	
3.2 Types of professional activity for which the graduate of the EP mainly prepares.	<p>In developing and implementing this program is focused on specific types of professional activity for which the bachelor is prepared, based on the needs of the labor market, research and material and technical resources of an educational organization:</p> <ul style="list-style-type: none"> - chemical analysis assistant, laboratory chemist, laboratory technician, laboratory technician- researcher (in the field of chemistry) to conduct chemical and physicochemical analysis of various substances: ores, oil and oil products, steels of various grades, alloys of metals, acids, salts, etc. necessary to control the conformity of the products of the technological process and the finished products with specified standards; laboratory analyst, laboratory ecologist, chemical technologist, forensic expert to carry out work related to quality control of raw materials, reagents, intermediate products, finished products, waste products in various sectors of the economy; laboratory assistant, teacher, teacher of chemistry in educational institutions.
3.3 Analysis and needs of the labor market for graduates of this EP	<p>For the future employment of graduates of the program, key employers in the specialty “5B060600 – Chemistry” are:</p> <ul style="list-style-type: none"> - production, organizations of chemical, metallurgical, petrochemical, pharmaceutical industry, - laboratories of analytical, environmental, sanitary-epidemiological, certification services, - research organizations (institutes, laboratories) of chemical, metallurgical, petrochemical, pharmaceutical profile - educational institutions: secondary schools, colleges, lyceums, gymnasiums, universities; departments of education expertise and forensic laboratories
4. Requirements for applicants	<ul style="list-style-type: none"> - Admission to the EP "6B05301-Chemistry" is carried out on the basis of competitive selection by admission following the results of the examination by the examination commission of UNT scores, results of entrance examinations in the disciplines: "Chemistry" and "Biology".

Appendix 2.1
Matrix of formation of competencies in the modules of the educational program

№	Название модуля	Формируемые результаты обучения												
		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1.	Module of social and cultural development				x									x
2.	Instrumental module				x									
3.	Module Physical Training				x	x				x	x	x		
4.	General chemistry and mathematics	x	x	x		x	x	x		x	x			
5.	Physics and Physical chemistry	x	x			x				x	x	x		
6.	Inorganic and organic chemistry	x		x	x		x	x		x				
7.	Analytical chemistry	x		x	x	x		x			x			
8.	Structure of matter and physical research methods			x	x	x	x		x	x	x	x		
9.	Metrology and standardization in chemistry				x	x	x	x	x	x	x	x		
10.	Physico-chemical systems and its modelling	x	x	x				x		x	x			
10.	Modelling in chemistry		x	x			x	x		x	x	x		
11.	Basis of Chemical Technology	x	x	x	x			x			x		x	
12.	Chemical physics		x		x	x	x	x	x		x		x	
13.	Chemical Expertise		x		x	x			x	x	x		x	
13.	Theoretical and Applied Chemistry	x	x	x	x	x	x			x	x			
13.	Macro and microchemistry	x	x	x	x	x	x	x			x			
13.	Green chemistry	x	x	x	x				x		x		x	
13.	Nanochemistry	x	x	x	x	x					x	x	x	