KAZAKH NATIONAL WOMEN'S TEACHER TRAINING UNIVERSITY
www.kazmkpu.kz

CATALOG OF ELECTIVE DISCIPLINES

Almaty 2024

EDUCATIONAL PROGRAMME: 6B05301-CHEMISTRY

1. OPTIONAL COMPONENTS OF THE CYCLE OF GENERAL COURSES

Optional component 1

Course: **Fundamentals of Legal Literacy and Anti-Corruption culture**
Intensity of the Course: 5 academic credits
Module Code: **GES -1**
Module Name: General educational subjects module
Prerequisites: Basics Law (school cours)
Purpose: formation of a legally competent, law-abiding person who knows his rights and duties, intolerant of any manifestations of corruption.
Short Description: The course is aimed at the formation of a legally competent, law-abiding person who knows his rights and obligations, intolerant of any manifestations of corruption. Students will be able to operate with the social, legal and ethical norms of Kazakhstani society.
Learning Outcomes in EP (LOP):
LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential
LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems.

Learning Outcomes in Course (LOC):
LOC 1 - To know the importance and role of legal culture in the life of society, its relationship with the political culture of the individual and the main definitions of corruption;
LOC 2 - Analyze the main obstacles on the way to ensuring the inalienable human rights; the role of human rights in personal life and in the life of society;
LOC 3 - Apply the acquired knowledge in political analysis, in the activities of public authorities, political and public organizations, analyze problems related to corruption and countering it;
LOC 4 - Be able to engage in dialogue as a way of relating to legal culture and society.
Post requisites: no

Optional component 1

Course: **Ecology and Sustainable Development**
Intensity of the Course: 5 academic credits
Module Code: **GES -1**
Module Name: General educational subjects module
Prerequisites: Biology (school program)
Purpose: To develop students' environmental skills, address modern ecological issues, strengthen the relationship between society and nature, and enhance environmental awareness and responsibility for protecting the environment, thereby ensuring their formation as active and responsible citizens.
Short Description: The course aims to develop students' environmental skills, solve modern environmental problems, form ways to develop relationships between society and nature, increase students' awareness of the environment, and their responsibility for protecting it. As a result, students will learn how to maintain vital balance by analyzing environmental trends and identifying priority areas for conserving nature. They will also be able to identify the main directions of modern environmental policy and practical approaches to addressing environmental issues at the global, regional and local levels. In addition, students will gain knowledge of various tools for managing environmental quality that can be used to achieve sustainable development objectives.
Learning Outcomes in EP (LOP):
LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential
LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems.
LOP 3 - Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.
Learning Outcomes in Course (LOC):

LOC 1 - Environmental Education and Skills: Students gain deep knowledge about environmental issues and principles of sustainable development, and acquire skills in environmental monitoring and data analysis.

LOC 2 - Environmental Responsibility and Activism: Students recognize their responsibility for protecting the environment and strive to actively participate in environmental initiatives, aiming to make changes in society.

LOC 3 - Understanding the Relationship between Society and Nature : Students comprehend the relationship between society and nature, develop environmental ethics and sustainable development strategies, enabling them to address social and environmental issues.

Post requisites: no

Optional component 1

Course: **Fundamentals of Economics and Entrepreneurship**

Intensity of the Course: 5 academic credits

Module Code: **GES -1**

Module Name: General educational subjects module

Prerequisites: Fundamentals of Entrepreneurship and bissnes (school course)

Purpose: familiarization of students with the basics of economics and entrepreneurship, mastering the conceptual apparatus and basic forms of doing business.

Short Description: The discipline is focused on the formation of students' skills of entrepreneurship and business thinking. Through a comprehensive view of the laws of the functioning of the economy, the conditions for doing business, its internal and external environment, students will have the skills to develop a business plan, create and successfully run their own business.

Learning Outcomes in EP (LOP):

LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems.

LOP 3 - Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.

Learning Outcomes in Course (LOC):

LOC 1 - Know the basic concepts in the field of economics and entrepreneurship;

LOC 2 - Be able to find and use the necessary economic information; determine the organizational and legal forms of organizations;

LOC 3 - Determine the composition of the material, labor and financial resources of the organization;

LOC 4 - Evaluation of a business idea and development of a business plan.

Post requisites: no

Optional component 1

Course: **Fundamentals of Leadership and receptivity to innovation**

Intensity of the Course: 5 academic credits

Module Code: **GES -1**

Module Name: General educational subjects module

Prerequisites: no

Purpose: in the process of studying the discipline, the student develops the skills of setting goals and objectives, timely planning of group work, problem solving, a sense of responsibility and effective communication.

Short Description: The course contributes to the disclosure and development of leadership qualities in the personality of each student, the development of innovative susceptibility skills in him, as a process of adaptation to innovations caused by innovative processes, as well as the use of the results of scientific and technical processes in his life and professional activities. Studies the current state and prospects for the development of leadership qualities and the human factor in management.

Learning Outcomes in EP (LOP):

LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems.

Learning Outcomes in Course (LOC):

LOC 1 - Understands theoretical and applied research in the field of modern management achievements in Kazakhstan and abroad using modern scientific methods;

LOC 2 - Knows how to work effectively individually and in a team;

LOC 3 - Independently study and continuously improve their qualifications throughout the entire period of professional activity;

LOC 4 - Applies professional knowledge in the field of organizational and managerial activities.

Post requisites: no

Optional component 1

Course: **Emotional Intellect**

Intensity of the Course: 5 academic credits

Module Code: **GES -1**

Module Name: General educational subjects module

Prerequisites: no

Purpose: knowledge and ability to apply modern methods of diagnostics and development of emotional intelligence of students and soft skills, including in the format of distance learning.

Short Description: The discipline is aimed at mastering the role of a tutor by the teacher in the context of strategic guidelines and priority areas of the state educational policy of Kazakhstan. Students determine the place of emotional intelligence and "flexible competencies" in the educational process of the modern school. They apply modern methods and technologies for organizing educational activities, taking into account the development of soft skills, including in the digital environment. They possess technologies for assessing and developing the emotional intelligence of students of different age groups.

Learning Outcomes in EP (LOP):

LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems.

LOP 3 - Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.

Learning Outcomes in Course (LOC):

LOC 1 - Modern methods and technologies of organizing educational activities taking into account the development of soft skills, diagnostics and evaluation of flexible skills, the formation of individual educational directions and methods of organizing group activities;

LOC 2 - Application of modern methods and technologies for organizing educational activities, taking into account the development of flexible skills, including in the digital environment;

LOC 3 - Flexible skills on the skillfolio platform have the ability to carry out complex diagnostics of soft skills, interpret the results and develop them both in individual and group forms of training.

Post requisites: no

Optional component 1

Course: **Fundamentals of mathematical statistics**

Intensity of the Course: 5 academic credits

Module Code: **GES -1**

Module Name: General educational subjects module

Prerequisites: Mathematics (school programe)

Purpose: is to familiarize students with the forms and laws of consistent thinking, to teach students to think consistently, to contribute to the development of skills of sound argumentation.

Short Description: Students understand the process of collecting, processing data and transmitting ideas, develop skills in using quantitative and qualitative data analysis in assessing the state of the object or phenomenon in question.

Learning Outcomes in EP (LOP):

LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems.

LOP 3 - Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.

Learning Outcomes in Course (LOC):

LOC 1 - The student summarizes the results of pedagogical and scientific research and learns to process them mathematically.

LOC 2 - Learns to systematize, clarify and use statistical data using statistical and mathematical methods.

LOC 3 - Effectively uses Chi-square, SSPP and Jamovi applications that statistically process the collected numbers.

Post requisites: no

Optional component 1

Course: **Financial Literacy**

Intensity of the Course: 5 academic credits

Module Code: **GES -1**

Module Name: General educational subjects module

Prerequisites: no

Purpose: is to develop students' knowledge and practical skills in personal finance management, allowing them to make informed financial decisions and ensure their financial well-being.

Short Description: The discipline is focused on the development of students' knowledge about the financial system, financial institutions and their products, and financial risks. As a result, students will be able to find, analyze, interpret, evaluate financial information from various sources and use it to solve financial problems. In general, the course forms students' competent rational financial behavior in conditions of increased risk of financial fraud.

Learning Outcomes in EP (LOP):

LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems.

LOP 3 - Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.

Learning Outcomes in Course (LOC):

LOC 1 - To know the basic financial concepts, the principles of financial markets, types of taxes, the basics of insurance, the possibilities of financial technologies.

LOC 2 - Be able to make a personal budget, analyze financial proposals, choose suitable financial products and services, make informed financial decisions, and protect your financial interests.

LOC 3 - Possess the skills of financial planning, investment, and risk management.

LOC 4 - Demonstrate financial literacy in everyday life, make responsible decisions in the field of finance.

Optional component 2

Course: **English for Academic Purposes**

Intensity of the Course: 5 academic credits

Module Code: **GLC -2**

Module Name: Language communication

Prerequisites: Foreign Language

Purpose: students' mastery of a foreign language as a means of learning and the basics of scientific academic communication.

Short Description: The subject forms knowledge about the genre varieties of the scientific style, mastering modern methods of collecting, storing and processing information and materials in the field of professional activity, as well as the development of skills and abilities of academic communication in four types of speech activity: reading, speaking, writing, listening.

Learning Outcomes in EP (LOP):

LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems.

LOP 3 - Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.

Learning Outcomes in Course (LOC):

LOC 1 – They know general scientific terms to the extent sufficient to work with original scientific texts and texts of a professional nature;

LOC 2 – They understand the peculiarities of the organization of the structure and content of an academic text/discourse, compositional and speech types, forms of presentation, methods of analysis and argumentation;

LOC 3 – They are able to conduct scientific research, including the choice of a topic, its justification, determination of relevance, novelty and significance, organization of research stages, registration of results, formulation of conclusions, conclusions and recommendations;

LOC 4 – Apply the acquired knowledge in educational and research activities in the specialty profile.

Post requisites: no

Course: **Academic writing**

Intensity of the Course: 5 academic credits

Module Code: **GLC -2**

Module Name: Language communication

Prerequisites: Foreign Language

Purpose: students' mastery of the theory of academic writing as a system, as well as concepts and models of academic writing.

Short Description: The discipline develops students' skills in functional style and writing scientific articles, industry-specific subject terminology, office management, and academic literacy. Students also learn how to compile scientific reports, professional text analysis, critical thinking, plagiarism prevention and information retrieval in scientific databases, and systematization of written work.

Learning Outcomes in EP (LOP):

LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems.

LOP 3 - Demonstrate knowledge of and adherence to ethical and legal norms in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.

Learning Outcomes in Course (LOC):

LOC 1 – They know the models of academic writing, the logical and syntactic rules of scientific text, the methodology of scientific text execution;

LOC 2 – They are able to collect and process material, structure work and describe bibliographic sources;

LOC 3 – She is able to substantiate the relevance, theoretical and practical significance of the chosen topic of scientific research and present its results;

LOC 4 – He knows the methodology of writing the scientific text of an article, an abstract, an essay, a graduation project.

Post requisites: no

Optional component 3

Course: **Professional Ethics and Identity**

Intensity of the Course: 5 academic credits

Module Code: **GER – 3**

Module Name: Global Ethics and Research

Prerequisites: no

Purpose: is to acquaint students with the attitudes, values, knowledge, beliefs and skills adopted in the professional pedagogical environment.

Short Description: Students develop leadership and proactivity skills in the context of pedagogical activity or outside it, develop a commitment to the national and cultural values of Kazakhstan, get acquainted with and accept as a value the strict observance of professional ethics. Students plan their career path, develop introspection and self-management skills.

Learning Outcomes in EP (LOP):

LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems.

Learning Outcomes in Course (LOC):

LOC 1 – Be able to work in a team, be tolerant social, ethnic, religious and cultural differences

LOC 2 – They know classical and modern theories in the field of professional ethics and identity;

LOC 3 – Apply theoretical knowledge and practical skills in the subject area in solving professional tasks;

Post-requisites: no

Course: **Basics of artificial intelligence**

Intensity of the Course: 5 academic credits

Module Code: **GER – 3**

Module Name: Global Ethics and Research

Prerequisites: Information – communication technologies

Purpose: The aim of teaching this discipline is to form theoretical knowledge and practical skills in artificial intelligence (AI), including implementing the contemporary tools and methods of AI..

Short Description: Students will be introduced to fundamental AI concepts, study its basic principles and methods, gain the skills to apply these theories, methods, and principles in simple intelligent software systems.

Learning Outcomes in EP (LOP):

LOP 1 - Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential

LOP 2 - Possess high-level critical and creative thinking skills, are capable of self-regulation and reflection to solve professional problems.

Learning Outcomes in Course (LOC):

LOC 1- know about the basic concepts of artificial intelligence (machine learning, neural networks, natural language processing), algorithms and artificial intelligence tools.

LOC 2- create simple artificial intelligence tools (for example, chatbots, recommendation systems, applications) adapted to the needs of their industry.

LOC 3 - be able to use practical AI tools and techniques to solve specific tasks.

Post-requisites: no

2. OPTIONAL COMPONENTS OF THE CYCLE OF CORE COURSES

Optional component 1

Course: **Chemistry of elements**

Intensity of the Course: 5 academic credits

Module Code: FCh-4

Module Name: Fundamentals of Chemistry

Prerequisites: Inorganic chemistry 1,2

Purpose: Study of the electronic structure of elements of the periodic table of chemical elements named after D. I. Mendeleev, their chemical and physical properties, methods of production and applications.

Short Description: The course provides knowledge on the basic laws of chemical reactions from the standpoint of thermodynamics and chemical kinetics; structure, properties, relationships between the structure and properties of the chemical elements of the periodic table and the compounds formed by them; on the technique of chemical experiment; laboratory and industrial methods for obtaining important inorganic compounds. When mastering the discipline, students will use the basic concepts and laws of chemistry of elements in solving chemical problems; determines the most probable properties of substances based on its elemental composition, masters the technique of conducting chemical experiments in laboratory conditions; the most well-known methods for obtaining important inorganic compounds in laboratory conditions; safety precautions when performing the experiment; basics of chemical science for further in-depth study of the subjects of the chemical cycle.

Learning Outcomes in EP (LOP):

LOP 5 – Students master the basics of the theory of fundamental sections of inorganic and organic chemistry; are able to substantiate the laws and causes of changes in the structure and properties of chemicals, aliphatic, cyclic and macromolecular compounds.

LOP 6 – Possess the skills of performing chemical experiments and interpreting their results.

LOP 9 – Possess theoretical knowledge and practical skills of analysis by physicochemical and chromatographic methods; are able to competently use modern analytical equipment when conducting experiments in their professional activities.

Learning Outcomes in Course (LOC):

LOC1 – Knows more about chemical elements and their new facets.

LOC2 – Be able to describe changes in the properties of elements of the periodic table and conduct theoretical analysis in quantum physical terms.

LOC3 – Able to experiment with obtaining chemical elements and chemical-physical properties.

LOC4 – The laboratory develops skills for working with various chemical elements in terms of toxicity and Flammability.

LOC5 – As a chemically literate person, they can conduct research on elements and form an independent opinion.

Post requisites: Fundamentals of scientific research.

Course: **Chemistry of transuranic elements**

Intensity of the Course: 5 academic credits

Module Code: FCh-4

Module Name: Fundamentals of Chemistry

Prerequisites: Inorganic chemistry 1

Purpose: Give students knowledge about the properties of transuranic chemical elements and their compounds.

Short Description: The subject studies the chemistry of radioactive isotopes, transuranium elements and substances, the laws and their physical and chemical conduct, the chemistry of nuclear transformations and the physical and chemical processes accompanying them. It will also develop the ability to draw up technological schemes for the production of transuranium elements.

Learning Outcomes in EP (LOP):

LOP 5 – Students master the basics of the theory of fundamental sections of inorganic and organic chemistry; are able to substantiate the laws and causes of changes in the structure and properties of chemicals, aliphatic, cyclic and macromolecular compounds.

LOP 6 – Possess the skills of performing chemical experiments and interpreting their results.

LOP 11 – Existing experimental methods and technologies for obtaining chemical and nanochemical substances are analyzed from the point of view of their safety for the environment and humans.

Learning Outcomes in Course (LOC):

LOC1 – Knows more about chemical elements and their new facets.

LOC2 – Be able to describe changes in the properties of elements of the periodic table and conduct theoretical analysis in quantum physical terms.

LOC3 – Able to experiment with obtaining chemical elements and chemical-physical properties.

LOC4 – The laboratory develops skills for working with various chemical elements in terms of toxicity and Flammability.

LOC5 – As a chemically literate person, they can conduct research on elements and form an independent opinion.

Post requisites: Fundamentals of scientific research.

Optional component 2

Course: **Qualitative analysis**

Intensity of the Course: 6 academic credits

Module Code: FCh-4

Module Name: Fundamentals of Chemistry

Prerequisites: Inorganic chemistry 1, Inorganic chemistry 2

Purpose: Teaching general theoretical foundations of modern analytical chemistry and qualitative analysis and using the theoretical knowledge obtained.

Short Description: The course gives students the theoretical foundations of modern high-quality semi-microanalysis, to give in-depth knowledge of the analytical reactions of cations and anions; to acquaint them with the general principles of the mechanisms of chemical reactions used in analytical chemistry, methods of separation, concentration and qualitative determination of elements and their compounds.

Learning Outcomes in EP (LOP):

LOP 6 – Possess the skills of performing chemical experiments and interpreting their results.

LOP 7 – On the basis of fundamental theoretical knowledge, they are able to evaluate the possibilities of physical and chemical methods, reasonably choose the appropriate method for a specific practical task, competently use modern analytical equipment when conducting experiments, mathematically process research results, synthesize organic compounds, conduct a qualitative and quantitative analysis of organic compounds.

LOP 9 – Possess theoretical knowledge and practical skills of analysis by physicochemical and chromatographic methods; are able to competently use modern analytical equipment when conducting experiments in their professional activities.

Learning Outcomes in Course (LOC):

LOC1 – identify the main types of chemical reactions used in analytical chemistry;

LOC2 – explain the theory of solutions, properties of weak and strong electrolytes, activity, equilibrium constants;

LOC3 – use the main provisions of the hydrolysis theory, the mechanism of buffer action;

LOC4 – distinguish analytical groups of anions and cations, choose a group reagent;

LOC5 –planning a systematic and detailed analysis of cations and anions;

LOC6 – offer qualitative analysis, make appropriate conclusions, calculations, and mathematical processing of the analysis results;

LOC7 – to protect the performance of laboratory work on the discovery of cations and anions in accordance with the method of analysis.

Post requisites: Chemical technology.

Course: **Chromatographic research methods**
Intensity of the Course: 6 academic credits
Module Code: FCh-4
Module Name: Fundamentals of Chemistry
Prerequisites: Inorganic chemistry 1, Inorganic chemistry 2
Purpose: Formation of students' analytical skills in determining and separating the chemical composition of substances in various mixtures.
Short Description: To study the main chemical methods of analysis (titrimetric, gravimetric), separation and concentration methods, metrological aspects and objects of chemical analysis; the theoretical foundations and areas of application of modern instrumental methods of analysis are considered: spectroscopic, electrochemical, chromatographic and physical. Practical classes are aimed at acquiring practical skills in working with modern analytical equipment using various methods of chemical analysis.
Learning Outcomes in EP (LOP):
LOP 6 – Possesses the skills of conducting chemical experiments and interpreting their results.
LOP 7 **–** On the basis of fundamental theoretical knowledge, they are able to evaluate the possibilities of physical and chemical methods, reasonably choose the appropriate method for a specific practical task, competently use modern analytical equipment when conducting experiments, mathematically process research results, synthesize organic compounds, conduct a qualitative and quantitative analysis of organic compounds.
LOP 9 **–** Possess theoretical knowledge and practical skills of analysis by physicochemical and chromatographic methods; are able to competently use modern analytical equipment when conducting experiments in their professional activities.
Learning Outcomes in Course (LOC):
LOC1 – determines the quantitative and qualitative composition of the analyzed object;
LOC2 – studies the kinetics of certain reactions;
LOC3 – distinguishes analytical chemistry methods: chemical, physico-chemical, and physical.
LOC4 – uses analytical instruments: analytical scales, pH meter, potentiometer
LOC5 – separates the defined component by various separation methods.
LOC6 – evaluates and proves the composition of the substance based on laboratory results.
LOC7 – conducts scientific search for information on new methods for determining substances.
Post requisites: Chemical technology.

Optional component 3

Course: **Quantitative analysis**
Intensity of the Course: 5 academic credits
Module Code: FCh-4
Module Name: Fundamentals of Chemistry
Prerequisites: Inorganic chemistry 1, Chemistry of elements
Purpose: Training in quantitative analysis methods: sampling, sample preparation for analysis; training in the theoretical foundations of quantitative analysis: equilibrium in heterogeneous processes, gravimetric analysis method, acid-base titration, redoxymetry, complexometry, deposition method.
Short Description: The course gives students the theoretical foundations of modern quantitative analysis, gives deep knowledge of quantitative (chemical and a number of physico-chemical) methods for determining elements and their compounds, and prepares them for independent work with these methods of analysis.
Learning Outcomes in EP (LOP):
LOP 6 – Possess the skills of performing chemical experiments and interpreting their results.
LOP 7 – On the basis of fundamental theoretical knowledge, they are able to evaluate the possibilities of physical and chemical methods, reasonably choose the appropriate method for a specific practical task, competently use modern analytical equipment when conducting experiments, mathematically process research results, synthesize organic compounds, conduct a qualitative and quantitative analysis of organic compounds.
LOP 9 – Possess theoretical knowledge and practical skills of analysis by physicochemical and chromatographic methods; are able to competently use modern analytical equipment when conducting experiments in their professional activities.
Learning Outcomes in Course (LOC):
LOC1 – Knows the determination of the content of various components that make up the analyzed substance, as well as the quantitative ratio of the components of the analyzed mixture.
LOC2 – can determine the atomic, molar and equivalent masses of substances.
LOC3 – Determine the number of ions and molecules, elements that make up the studied substances.
LOC4 – Determine the quality of the substance, which depends on the content of the main components and the amount of impurities. This allows you to determine that the items are suitable for use at the time.
LOC5 – is Able to distinguish chemical methods of quantitative and analyze in accordance with the law of stability, the law of conservation of mass.
Post requisites: Chemical synthesis, General chemistry

Course: **Basics of metrology and standardization**

Intensity of the Course: 5 academic credits
Module Code: FCh-4
Module Name: Fundamentals of Chemistry
Prerequisites: Qualitative analysis
Purpose: The purpose of studying the discipline is to develop students ' knowledge in the fields of theoretical Metrology, qualimetry, standardization and certification, as well as to teach them practical skills in working with regulatory and technical documentation and means of measuring physical quantities.
Short Description: The course gives an idea of the basic concepts and metrology concepts of modern chemical analysis, teaches students to solve a wide class of problems, and conveys experience in the effective application of methods of mathematical statistics in scientific activities. Forms an understanding, knowledge, and skill in the field of storage, processing, and standardization of chemical products.
Learning Outcomes in EP (LOP):
LOP 5– Students master the basics of the theory of fundamental sections of inorganic and organic chemistry; are able to substantiate the laws and causes of changes in the structure and properties of chemicals, aliphatic, cyclic and macromolecular compounds.
LOP 7 – On the basis of fundamental theoretical knowledge, they are able to evaluate the possibilities of physical and chemical methods, reasonably choose the appropriate method for a specific practical task, competently use modern analytical equipment when conducting experiments, mathematically process research results, synthesize organic compounds, conduct a qualitative and quantitative analysis of organic compounds.
LOP 9 – Possess theoretical knowledge and practical skills of analysis by physicochemical and chromatographic methods; are able to competently use modern analytical equipment when conducting experiments in their professional activities.
Learning Outcomes in Course (LOC):
LOC1 –Organize your own activities, choose standard methods and methods for performing professional tasks, and evaluate their effectiveness and quality.
LOC2 –Make decisions in standard and non-standard situations and be responsible for them.
LOC3 –Work in a team and in a team, communicate effectively with colleagues, management, and consumers.
LOC4 –Navigate the conditions of frequent changes in technology in professional activities.
Post requisites: Chemical technology.

Optional component 4

Course: **Higher mathematics**
Intensity of the Course: 5 academic credits
Module Code: FCh-4
Module Name: Fundamentals of Chemistry
Prerequisites: Mathematics (school courses)
Purpose: deepen students' knowledge in the following branches of higher mathematics: linear algebra, analytical geometry, differential and integral calculations of functions of one and many variables, probability theory and mathematical statistics.
Short Description: The purpose of the subject: to deepen students' knowledge in the following areas of higher mathematics: linear algebra, analytical geometry, differential and integral calculations of functions of one and many variables, probability theory and mathematical statistics.
Learning Outcomes in EP (LOP):
LOP 1 – Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential.
LOP 3 – Demonstrate knowledge of and compliance with ethical and legal standards in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.
Learning Outcomes in Course (LOC):
LOC1 – Knows about the basic concepts, definitions, formulas, theorems, and methods for solving problems in the listed sections;
LOC2 – Can apply modern mathematical methods to solve applied problems;
LOC3 – Can solve engineering problems using mathematical methods;
LOC4 – when choosing mathematical modeling methods for solving specific technical problems;
LOC5 – Develops logical thinking and mathematical culture.chemical methods of quantitative and analyze in accordance with the law of stability, the law of conservation of mass.
Post requisites: No.

Course: **Applied Mathematics**
Intensity of the Course: 5 academic credits
Module Code: FCh-4

Module Name: Fundamentals of Chemistry

Prerequisites: Mathematics (school courses)

Purpose: formation of knowledge, skills and abilities of students on the theoretical foundations of the higher mathematics course.

Short Description: The purpose of the discipline: the formation of the personality of students, the development of their intellect and logical and algorithmic thinking; expansion of professional opportunities; determination of the role and place of mathematics in the field of chemistry.

Learning Outcomes in EP (LOP):

LOP 1 – Applies a variety of communication formats taking into account socio-cultural diversity, adheres to the principles of equality and accessibility in education, to create a prosperous and inclusive environment, has leadership qualities and is able to apply them to develop collective potential.

LOP 3 – Demonstrate knowledge of and compliance with ethical and legal standards in research and use of digital technologies. Apply security measures when working with digital information and data protection, promote the active, safe and ethical use of digital resources.

Learning Outcomes in Course (LOC):

LOC1 – basic concepts, definitions, formulas, theorems, and methods for solving problems in the listed sections;

LOC2 – apply modern mathematical methods to solve applied problems;

LOC3 – solving logical problems using mathematical methods;

LOC4 – when choosing mathematical modeling methods for solving specific technical problems;

LOC5 – develop logical thinking and mathematical culture..chemical methods of quantitative and analyze in accordance with the law of stability, the law of conservation of mass.

Post requisites: No.

3. OPTIONAL COMPONENTS OF THE CYCLE OF MAJOR COURSES

Optional component 1

Course: **Chemistry of natural compounds**

Intensity of the Course: 5 academic credits

Module Code: FOCh-6

Module Name: Fundamentals of organic chemistry

Prerequisites: Organic chemistry 1, Organic chemistry 2

Purpose: to acquaint students with methods, methods and techniques of analysis of natural biological substances; to give an idea of the theoretical foundations of chemical and physico-chemical methods of analysis of biological active substances; to develop the ability to apply the methods of chemical and physico-chemical analysis in practice to obtain biological active substances.

Short Description: The course examines the structural components, properties and structural organization of lipid molecules, carbohydrates, peptides and proteins, nucleic acids, the structure of the most important representatives of low molecular weight biologically active compounds and bioregulators.

Learning Outcomes in EP (LOP):

LOP 7 – On the basis of fundamental theoretical knowledge, they are able to evaluate the possibilities of physical and chemical methods, reasonably choose the appropriate method for a specific practical task, competently use modern analytical equipment when conducting experiments, mathematically process research results, synthesize organic compounds, conduct a qualitative and quantitative analysis of organic compounds.

LOP 9 – Possess theoretical knowledge and practical skills of analysis by physicochemical and chromatographic methods; are able to competently use modern analytical equipment when conducting experiments in their professional activities.

LOP 11 – Existing experimental methods and technologies for obtaining chemical and nanochemical substances are analyzed from the point of view of their safety for the environment and humans.

Learning Outcomes in Course (LOC):

LOC1 – Knows the classification of natural chemical compounds, their presence in nature.

LOC2 – Has an understanding of the structural features of natural compounds and their main chemical transformations.

LOC3 – Know the methods of isolation, purification of natural compounds, as well as methods of their synthetic production.

LOC4 – Have an understanding of the effect of natural compounds on living organisms and their participation in the processes of metabolism. Have an understanding of methods for studying natural compounds.

LOC5 – working with the nomenclature of natural chemical compounds (trivial and systematic). Possess stereochemical nomenclatures and be able to use them to designate configurations of natural compounds.

Post requisites: General chemistry

Course: **Biochemistry and BAS**

Intensity of the Course: 5 academic credits

Module Code: FOCh-5

Module Name: Fundamentals of organic chemistry

Prerequisites: Organic chemistry 1, Organic chemistry 2

Purpose: knowledge of the methodology for determining the structures of the most important biomolecules, secondary metabolites and their synthesized biologically active derivatives.

Short Description: The course provides students with knowledge about the methodology for establishing the structures of the most important biomolecules, secondary metabolites and their synthesized biologically active derivatives. In the course of studying the course, students develop the ability to analyze the structure and nomenclature of different classes of biomolecules: proteins and peptides, complex carbohydrates and major groups of lipids.

Learning Outcomes in EP (LOP):

LOP 5 – Students master the basics of the theory of fundamental sections of inorganic and organic chemistry; are able to substantiate the laws and causes of changes in the structure and properties of chemicals, aliphatic, cyclic and macromolecular compounds.

LOP 7 – On the basis of fundamental theoretical knowledge, they are able to evaluate the possibilities of physical and chemical methods, reasonably choose the appropriate method for a specific practical task, competently use modern analytical equipment when conducting experiments, mathematically process research results, synthesize organic compounds, conduct a qualitative and quantitative analysis of organic compounds.

LOP 11 – Existing experimental methods and technologies for obtaining chemical and nanochemical substances are analyzed from the point of view of their safety for the environment and humans.

Learning Outcomes in Course (LOC):

LOC1 – must know the main pathways of metabolism and energy metabolism; the values of protein, lipid, and enzyme metabolism; General concepts of biochemistry, and biochemical methods for quality assessment.

LOC2 – is able to set up and conduct an experiment;

LOC3 – can analyze and process primary experimental material in biochemical research conducting experiments, using and developing the first biochemical studies of experimental material;

LOC4 – uses application programs to obtain, process, and interpret biochemical research data;

LOC5 – can evaluate the reliability of the data obtained, formulate conclusions, and creatively apply the knowledge gained to solve specific technological problems.

Post requisites: General chemistry

Optional component 2

Course: **Petroleum Chemistry**

Intensity of the Course: 5 academic credits

Module Code: FOCh-5

Module Name: Fundamentals of organic chemistry

Prerequisites: Organic chemistry 1, Organic chemistry 2

Purpose: provide knowledge about the composition and properties of oil systems of various origins, methods of their research, separation, classification, and the relationship between the composition, thermodynamic conditions, and physical and chemical properties.

Short Description: The course provides knowledge about the composition and properties of petroleum systems of various origins, methods for their study, separation, classification and the relationship between composition, thermodynamic conditions and physico-chemical properties, the formation of the ability to apply knowledge in the field of primary preparation of oil for processing, the development of methods for demulsifying petroleum emulsions.

Learning Outcomes in EP (LOP):

LOP 6 – Possesses the skills of conducting chemical experiments and interpreting their results.

LOP 9 – Possess theoretical knowledge and practical skills of analysis by physicochemical and chromatographic methods; are able to competently use modern analytical equipment when conducting experiments in their professional activities.

LOP 11 – Existing experimental methods and technologies for obtaining chemical and nanochemical substances are analyzed from the point of view of their safety for the environment and humans.

Learning Outcomes in Course (LOC):

LOC1 –Knows the component composition of oil and other hydrocarbon systems of natural and man-made origin; physical and chemical properties of the main classes of hydrocarbons and heteroatomic compounds of oil.

LOC2 –Can use the principles of classification of oil and gas systems; apply knowledge about the composition and properties of oil and gas in the relevant calculations.

LOC3 –Can conduct standard experiments, process, interpret results, and draw conclusions.

LOC4 –Can use standard software tools and use a physical and mathematical apparatus for solving computational and analytical problems.

LOC5 – can predict the behavior of oil and gas under various thermodynamic conditions, based on knowledge of their composition and physical and chemical properties.

Post requisites: General chemistry

Course: **Geochemistry**

Intensity of the Course: 5 academic credits

Module Code: FOCh-5

Module Name: Fundamentals of organic chemistry

Prerequisites: Organic chemistry 1, Organic chemistry 2

Purpose: the laws of the distribution of elements, their relation to the construction of atoms in the periodic table of elements on Earth, on another planet.

Short Description: The course provides knowledge about the laws of distribution of elements, their connection with the construction of atoms in the periodic table of elements on Earth, on another planet, the laws of the chemical composition of the Earth, the laws of the transition and distribution of elements, methods of localization and transition of atoms in natural processes.

Learning Outcomes in EP (LOP):

LOP 5 – Students master the basics of the theory of fundamental sections of inorganic and organic chemistry; are able to substantiate the laws and causes of changes in the structure and properties of chemicals, aliphatic, cyclic and macromolecular compounds.

LOP 11 – Existing experimental methods and technologies for obtaining chemical and nanochemical substances are analyzed from the point of view of their safety for the environment and humans.

Learning Outcomes in Course (LOC):

LOC1 –Must know the General laws of Geochemistry;

LOC2 –Knows geochemical classifications of chemical elements;

LOC3 –Mastering General theoretical knowledge about Geochemistry and cosmochemistry, isotope Geochemistry, geochemical properties of elements, distribution patterns, migration conditions and concentration of chemical elements in natural and natural-anthropogenic systems;

LOC4 – the study of the geochemical classifications of the chemical elements according to various criteria;

LOC5 –analysis of geochemical maps using GIS technologies.

Post requisites: General chemistry

Optional component 3

Course: **Methods of solving complex problems in chemistry**

Intensity of the Course: 5 academic credits

Module Code: SBCh-6

Module Name: Selected branches of chemistry

Prerequisites: Inorganic chemistry 1, Organic chemistry 1, Physical chemistry

Purpose: The student should be able to apply concepts and solutions to experimental problems and other complex problems.

Short Description: An important component of this course is the ability to solve problems and exercises in chemistry, tasks of increased complexity. The ability to solve problems and exercises in chemistry is the main criterion for the creative assimilation of the discipline, it contributes to the formation of students' attentiveness, the ability to think logically, formulate questions and look for extraordinary solutions.

Learning Outcomes in EP (LOP):

LOP 5 **–** Students master the basics of the theory of fundamental sections of inorganic and organic chemistry; are able to substantiate the laws and causes of changes in the structure and properties of chemicals, aliphatic, cyclic and macromolecular compounds.

LOP 6 **–** Possesses the skills of conducting chemical experiments and interpreting their results.

LOP 9 **–** Possess theoretical knowledge and practical skills of analysis by physicochemical and chromatographic methods; are able to competently use modern analytical equipment when conducting experiments in their professional activities.

Learning Outcomes in Course (LOC):

LOC 1 – Mastering methods for solving problems in chemistry;

LOC 2 – Can use reference, scientific and technical literature for solving chemical problems;

LOC 3 –Mastering the skills of the simplest ways to solve chemical problems;

LOC 4 –Analyze ways to solve experimental and complex problems in chemistry;

LOC 5 –Offers effective methods for solving chemical problems.

Post requisites: General chemistry

Course: **Chemistry tasks**

Intensity of the Course: 5 academic credits

Module Code: SBCh-6

Module Name: Selected branches of chemistry

Prerequisites: Inorganic chemistry 1, Organic chemistry 1, Physical chemistry

Purpose: Develop students ' creative abilities and teach them to use the basic laws and concepts of chemistry in solving experimental, computational, and other problems of increased complexity.

Short Description: In the course of studying the course, develop students' creative abilities and teach them to use the basic laws and concepts of inorganic chemistry in solving experimental, computational and other problems of increased complexity, teach students how to solve problems in several alternative ways, and choose the most elegant ways to solve them. The formation of students ’knowledge and skills in teaching students how to solve chemical problems.

Learning Outcomes in EP (LOP):

LOP 5 **–** Students master the basics of the theory of fundamental sections of inorganic and organic chemistry; are able to substantiate the laws and causes of changes in the structure and properties of chemicals, aliphatic, cyclic and macromolecular compounds.

LOP 6 – Possesses the skills of conducting chemical experiments and interpreting their results.

LOP 9 – Possess theoretical knowledge and practical skills of analysis by physicochemical and chromatographic methods; are able to competently use modern analytical equipment when conducting experiments in their professional activities.

Learning Outcomes in Course (LOC):

LOC1 – Mastering methods for solving problems in chemistry;

LOC2 – Can use reference, scientific and technical literature for solving chemical problems;

LOC3 – Mastering the skills of the simplest ways to solve chemical problems;

LOC4 – Analyze ways to solve experimental and complex problems in chemistry;

LOC5 – Offers effective methods for solving chemical problems.

Post requisites: General chemistry.

Optional component 4

Course: **Fundamentals of nanochemistry**

Intensity of the Course: 5 academic credits

Module Code: SBCh-6

Module Name: Selected branches of chemistry

Prerequisites: Fundamentals of scientific research

Purpose: formation of students ' knowledge about the basics of nanochemistry, synthesis and analysis of nanomaterials in chemistry.

Short Description: The course forms the basis for understanding the theoretical and applied foundations of nanochemistry and chemistry of nanostructured and nanoscale disperse systems. The discipline is aimed at studying the properties and classification of nanoparticles and nanostructured systems, methods for their preparation, the influence of the size effect on the physicochemical properties of nanoparticles, the practical importance of nanotechnology for the economy and development of science in Kazakhstan.

Learning Outcomes in EP (LOP):

LOP 4 – They have the skills to conduct research work, are able to analyze the results of research in the subject area.

LOP 10 – They are able to critically analyze and systematize the results of a study or test, incl. with the subsequent presentation of materials in the form of scientific reports, publications and presentations.

LOP 11 – Existing experimental methods and technologies for obtaining chemical and nanochemical substances are analyzed from the point of view of their safety for the environment and humans.

Learning Outcomes in Course (LOC):

LOC1 –Knows the basics of nanochemistry and nanotechnology, the main types of nanoobjects and nanomaterials, devices and devices developed on the basis of nanomaterials.

LOC2 –Predicts stability and physical and chemical properties of nanoobjects and nanomaterials

LOC3 –Focuses on modern literature on nanochemistry and nanotechnology;

LOC4 –Independently set tasks for creating or practical application of nanoobjects

LOC5 –Focuses on methods for obtaining and studying nanostructures.

LOC6 –Understands the mechanism of dimensional physical and chemical effects.

Post requisites: No.

Course: **Fundamentals of nanotechnology**

Intensity of the Course: 5 academic credits

Module Code: SBCh-6

Module Name: Selected branches of chemistry

Prerequisites: Physical research methods

Purpose: to acquaint students with practical scientific knowledge of nanotechnology, new achievements and directions of development in the modern interdisciplinary field.

Short Description: The course considers an overview of various nanotechnological processes for creating nanomaterials; review of the main trends in the development of nanotechnology in the world; study of the effects that determine the special patterns of the flow of various physical and chemical processes in spatial regions of nanometer sizes.

Learning Outcomes in EP (LOP):

LOP 4 – They have the skills to conduct research work, are able to analyze the results of research in the subject area.

LOP 10 – They are able to critically analyze and systematize the results of a study or test, incl. with the subsequent presentation of materials in the form of scientific reports, publications and presentations.

LOP 11 – Existing experimental methods and technologies for obtaining chemical and nanochemical substances are analyzed from the point of view of their safety for the environment and humans.

Learning Outcomes in Course (LOC):

LOC1 –Knows the basics of nanotechnology.

LOC2 –Predicts stability and physical and chemical properties of nanoobjects.

LOC3 –Focuses on the current literature on nanotechnology.

LOC4 –Independently set tasks for the creation or practical application of nanoobjects.

LOC5 –Focuses on methods for obtaining and studying nanostructures.

LOC6 –Understands the mechanism of dimensional physical and chemical effects.

LOC7 –Knows the specifics of the behavior of matter in the nanometer size range.

Post requisites: no.

Optional component 5

Course: **General chemistry**

Intensity of the Course: 4 academic credits

Module Code: SBCh-6

Module Name: Selected branches of chemistry

Prerequisites: Physical research methods

Purpose: give students knowledge about the properties of chemical elements and their compounds, based on D.I. Mendeleev's periodic law and modern information about the structure of substances and other concepts of theoretical inorganic and organic chemistry.

Short Description: The main goal of the course is to develop and consolidate skills in conducting experiments in chemistry, the ability to determine the direction and optimal conditions for the occurrence of chemical processes, to select and analyze substances used in technological processes in various industries. The chemistry course should provide a theoretical basis that allows one to navigate specific issues that arise during the passage of special disciplines or directly in the work practice of students, and help the future specialist

Learning Outcomes in EP (LOP):

LOP 5 **–** Students master the basics of the theory of fundamental sections of inorganic and organic chemistry; are able to substantiate the laws and causes of changes in the structure and properties of chemicals, aliphatic, cyclic and macromolecular compounds.

LOP 6 **–** Possesses the skills of conducting chemical experiments and interpreting their results.

LOP 10 – They are able to critically analyze and systematize the results of a study or test, incl. with the subsequent presentation of materials in the form of scientific reports, publications and presentations.

LOP 12 – They know the basic methods of searching and summarizing the information necessary to complete a thesis and professional tasks.

Learning Outcomes in Course (LOC):

LOC1 –Knows the composition, structure, properties of substances and the process of their transformation into other substances;

LOC2 –can perform calculations for the preparation of solutions of different concentrations;

LOC3 – Can use theoretical knowledge to solve complex problems in predicting the products of chemical processes, balancing redox reactions;

LOC4 – Able to work with inorganic and organic substances, allows you to prepare and conduct experiments in compliance with safety rules;

LOC5 –methods and techniques of teaching chemistry, planning and setting up experiments, analyzes and discusses the results of their professional activities;

Post requisites: No.

Course: **Chemical experiment**

Intensity of the Course: 4 academic credits

Module Code: SBCh-6

Module Name: Selected branches of chemistry

Prerequisites: Physical research methods

Purpose: methods of organizing and conducting school chemical experiments.

Short Description: The study of the main methodological approaches to setting up, conducting and processing the results of a chemical experiment, as well as familiarization with the mathematical methods used in planning an experiment. In the process of studying this discipline, the student expands and deepens the following competencies: - plan and conduct physical and chemical experiments, process their results and evaluate errors, mathematically model physical and chemical processes and phenomena, put forward hypotheses and set limits for their application.

Learning Outcomes in EP (LOP):

LOP 6 **–** Possesses the skills of conducting chemical experiments and interpreting their results.

LOP 7 – On the basis of fundamental theoretical knowledge, they are able to evaluate the possibilities of physical and chemical methods, reasonably choose the appropriate method for a specific practical task, competently use modern analytical equipment when conducting experiments, mathematically process research results, synthesize organic compounds, conduct a qualitative and quantitative analysis of organic compounds.

LOP 9 – Possess theoretical knowledge and practical skills in analysis using physicochemical and chromatographic methods; be able to competently use modern analytical equipment when conducting experiments in professional activities.

Learning Outcomes in Course (LOC):

LOC1 – Knows the main types of school chemical experiments.

LOC2 – Able to organize educational and cognitive activities of schoolchildren when conducting various types of school chemical experiments

LOC3 – Can help students develop scientific ideas about natural processes and phenomena and develop their interest in studying chemistry

LOC4 – Demonstrates skills in working in laboratory conditions, is able to conduct research activities in the field of chemistry and teaching methods

LOC5 – Selects and uses regulatory documents that determine the organization and safety of work in school chemical laboratories and environmental institutions

Post requisites: No.