KAZAKH NATIONAL WOMEN'S TEACHER TRAINING UNIVERSITY
INSTITUTE OF NATURAL SCIENCES
7M01504 – CHEMISTRY
Catalog of elective disciplines

CONTENT

KAZAKH NATIONAL WOMEN'S TEACHER TRAINING UNIVERSITY
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7M01504 – ХИМИЯ
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1. OPTIONAL COMPONENT OF THE CYCLE OF CORE COURSES

Component of choice 1

Course: **Selected chapters in inorganic chemistry**
Intensity of the Course: 4 academic credits
Module Code: **APMCh-2**
Module Name: **Actual aspects modern chemistry**
Prerequisites: ICh 1205 Inorganic chemistry

Purpose: Equipping undergraduates with theoretical knowledge about inorganic chemistry, teaching them to apply the knowledge gained in other areas of chemistry and practice.

Short Description: The place of modern inorganic chemistry in the system of sciences of the natural science cycle. The importance of inorganic chemistry for various fields of technology, medicine and agriculture. Periodic law, Periodic table of chemical elements: current state of the problem. The main features and tasks of modern inorganic chemistry: search, synthesis and design of new chemical compounds, creation of structural materials of the future.

Learning Outcomes:

Learning Outcomes in EP (LOP)

LOP 5 He possesses the skills of conducting scientific and experimental research in all branches of chemistry and methods of teaching the subject.
LOP 6 Analyzes the peculiarities of teaching natural subjects, assesses the effectiveness of innovations and scientific research from a critical point of view

Learning Outcomes in Course (LOC)

LOD 1 – Orientates in modern trends in the development of inorganic chemistry;
LOD 2 - Knows how to plan experiments depending on the task;
LOD 3 – Possesses the skills of working on modern equipment;
LOD 4 – Performs processing of the results of chemical experiments;
LOD 5 – Improves practical skills of working on modern equipment;
LOD 6 – Owns the methods of registration and processing of the results of chemical experiments;
LOD 7 - Uses the knowledge gained in practice.
Post requisites: HDChSK 5302 History and development of chemical science in Kazakhstan.

Component of choice 2

Course: **Theoretical inorganic chemistry**
Intensity of the Course: 5 academic credits
Module Code: **APMCh-2**
Module Name: **Actual aspects modern chemistry**
Prerequisites: ICh 1205 Inorganic chemistry
Purpose: Study and master the knowledge gained by students in the field of chemistry, inorganic chemistry and organic chemistry.
Short Description: The place of modern inorganic chemistry in the system of sciences of the natural science cycle. The importance of inorganic chemistry for various fields of technology, medicine and agriculture. Periodic law, Periodic table of chemical elements: current state of the problem. The main features and tasks of modern inorganic chemistry: search, synthesis and design of new chemical compounds, creation of structural materials of the future.
Learning Outcomes:

Learning Outcomes in EP (LOP)

LO 6- Analyzes the peculiarities of teaching natural subjects, assesses the effectiveness of innovations and scientific research from a critical point of view

LO 7 - Able to creatively apply knowledge in relevant areas of chemical research (nanotechnology, kinetics of electronic processes, heterocyclic compounds, etc.) in the educational process.

Learning Outcomes in Course (LOC)

LOD 1 – Owns the methods of registration and processing of the results of chemical experiments;

LOD 2 - Knows how to plan experiments depending on the task;

LOD 3 – Possesses the skills of working on modern equipment;

LOD 4 – Uses the knowledge gained in practice;

LOD 5 – Improves practical skills of working on modern equipment;

LOD 6 – Performs processing of the results of chemical experiments;

LOD 7 – Oriented in modern trends in the development of inorganic chemistry.

Post requisites: FN 6305 Fundamentals of Nanotechnology, ASCh 6304.1 Aspects of Surface Chemistry

Component of choice 3

Course: **Applied Foundations of Modern Organic Chemistry**

Intensity of the Course: 5 academic credits

Module Code: **APMCh-2**

Module Name: **Actual aspects modern chemistry**

Prerequisites: SChOCh3206 Selected Chapters in Organic Chemistry, ChTOS 4302.2 Chemical Technology of Organic Substances

Purpose: Fundamental education of undergraduates in organic chemistry. Basic theoretical problems of organic chemistry, hydrocarbons, nomenclature, isomerism, basic classes.

Short Description: The current state of applied organic chemistry. Organic synthesis: main stages, patterns and development trends. Organic catalysis. Reactivity and catalysis, mechanisms of catalytic reactions. Computer synthesis of complex organic compounds, molecular design. Mathematical and computer modeling in organic chemistry. Chemistry of life processes. New in the chemistry of proteins and nucleic acids. Engineering enzymology. Green chemistry as a way to create waste-free industries.

Learning Outcomes:

Learning Outcomes in EP (LOP)

LOP 7 - Able to creatively apply knowledge in relevant areas of chemical research (nanotechnology, kinetics of electronic processes, heterocyclic compounds, etc.) in the educational process.

LOP 8 - He owns a system of professional and general scientific knowledge that allows him to substantiate his position in the course of scientific discussions, to present the results obtained in research in the form of reports, scientific publications and patents.

Learning Outcomes in Course (LOC)

LOD 1 - The role of organic chemistry in the system of sciences and theoretical foundations of organic chemistry; LOD 2 - Adaptation of the acquired knowledge for solving specific problems related to professional activities; can independently work with educational and reference literature on organic chemistry;

LOD 3 – Theoretical concepts of organic chemistry, knowledge of the composition, structure and properties of organic substances - knows the representatives of the main classes of organic compounds;

LOD 4 – Mastering the basic methods of practical work in organic chemistry;
LOD 5 – Can apply basic knowledge of organic chemistry to practical problems;
LOD 6 – Can implement the ideas of the basics of organic synthesis, physicochemical methods for the analysis of organic compounds;
LOD 7 – Place of organic chemistry in the system of sciences, mastered the theoretical foundations of organic chemistry.
Post requisites: MNTPhChA 5302 Methods of new technologies for physical and chemical analyzes

Component of choice 4

Course: **Heterocyclic compounds**
Intensity of the Course: 5 academic credits
Module Code: **APMCh-2**
Module Name: **Actual aspects modern chemistry**
Prerequisites: APMOCh 5205 Actual problems of modern organic chemistry
Purpose: The ring of heterocycles can contain elements other than carbon. Construction of many derivatives of furan, thiophene, pyrrole, pyridine, pyrimidine compounds; production methods, chemical properties, and the importance of natural derivatives.
Short Description: Classification of heterocyclic compounds. Five-membered heterocycles with one heteroatom. Five-membered heterocycles with two or more heteroatoms. Six-membered heterocycles with one heteroatom. Six and seven membered heterocycles with two heteroatoms. Bicyclic heterocycles. Nucleic acids. The structure and structure of nucleic acids. DNA (deoxyribonucleic acids). RNA (ribonucleic acids).
Learning Outcomes:
Learning Outcomes in EP (LOP)
LOP 1 - Demonstrates knowledge of philosophy and methodology of science, allowing to plan and design research and innovation in the field of chemistry education.
LOP 8 - He owns a system of professional and general scientific knowledge that allows him to substantiate his position in the course of scientific discussions, to present the results obtained in research in the form of reports, scientific publications and patents.
Learning Outcomes in Course (LOC)
LOD 1 - Studying the classification of heterocyclic compounds;
LOD 2 - Forms the properties of heterocyclic compounds in the chemical, electronic and spatial structure;
LOD 3 - Can handle organic substances (liquids, solids, flammable, toxic, aromatic);
LOD4 - Distinguishes between five-membered heterocycles with one heteroatom and five-membered heterocycles with two or more heteroatoms;
LOD 5 - Learns about the importance of natural products
LOD 6 - Can draw graphs and diagrams;
LOD 7 - Can process the results of laboratory experiments.
Post requisites: AC 2303 Analytical Chemistry, MMA 3233 Modern Methods of Analysis

Component of choice 5

Course: **Modern problems of analytical chemistry**
Intensity of the Course: 5 academic credits

Module Code: **APMCh-2**
Module Name: **Actual aspects modern chemistry**
Prerequisites: Prerequisites: AC 2303 Analytical Chemistry,

Purpose: To acquaint undergraduates with the latest achievements in analytical chemistry, modern methods of detection, dissemination and determination. Provide the wizard with an understanding of the analytical methods used to quickly and fully assess the content of chemicals in an industrial and disaster area, as well as for eco-analytical monitoring of environmental objects.

Short Description: Introduction. Metrological foundations of chemical analysis. Types of chemical reactions and processes in analytical chemistry. Identification methods. Methods for isolation, separation and concentration. Chromatographic analysis methods. Gravimetric analysis method. Titrimetric methods of analysis. Kinetic methods of analysis. Electrochemical methods of analysis: potentiometry, coulometry, voltammetry, etc. Spectroscopic methods of analysis.

Learning Outcomes:

Learning Outcomes in EP (LOP)

LOP 4 Organizes an active independent activity for the development of students' mental abilities, is able to use and develop the theoretical foundations of traditional and new branches of chemistry in solving professional problems.
LOP 5 He possesses the skills of conducting scientific and experimental research in all branches of chemistry and methods of teaching the subject.

Learning Outcomes in Course (LOC)

LOD 1 – Knows the basics of modern analytical methods used to ensure chemical safety.
LOD 2 - Depending on the object of analysis and the task, you can choose the method of analysis, the conditions for the experiment.
LOD 3 – Acquisition of skills to work with modern equipment; mastered the methods of registration and processing of the results of chemical experiments in order to improve the practical skills of working with modern equipment, gain new knowledge related to the current state of the discipline, and apply the knowledge gained in practice.
LOD 4 – Understands the need for the safe handling of chemical materials, taking into account their physical and chemical properties, can assess the possible risks.
LOD 5 - Has a basic understanding of environmental chemistry, can assess the environmental risks of production.
LOD 6 - Can apply principles of green chemistry in chemical reaction design and process engineering.
LOD 7 - Understands and can obtain new knowledge using modern scientific methods and masters them at the level necessary to solve problems arising from the performance of professional functions that have a natural content.

Post requisites: MPhChR 2303 Methods of physical and chemical research

Component of choice 6

Course: **Selected Chapters of Analytical Chemistry**
Intensity of the Course: 5 academic credits
Module Code: **APMCh-2**
Module Name: **Actual aspects modern chemistry**
Prerequisites: AC 2303 Analytical Chemistry,

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Purpose: "Analytical chemistry of biological objects and medicines" is the development of professional skills of undergraduates in the study of the chemical composition of wildlife and medicines using modern methods of analysis of elements and materials, taking into account their specificity as objects of research, allowing to evaluate the processes of transformation and transfer. Biologically active substances and their metabolites in living organisms. At the same time, special attention is paid to practical skills with an emphasis on monitoring the reliability of the results obtained. During the course, undergraduates get acquainted with the theoretical parts of modern elementary and instrumental analysis of materials using inductively coupled plasma, capillary electrophoresis and high performance liquid chromatography and atomic emission spectrometry, based on basic knowledge of analytical chemistry. In practical classes, undergraduates master the methods of work and methodological techniques using these methods of analysis, the purpose of which is to determine the composition of micro- and macroelements, as well as organic substances and drugs in biosubstrates of humans and animals, including those on a plant basis.

Short Description: The content of the discipline includes questions, the development of professional skills in the study of the chemical composition of the animal world and medicines using modern methods of analysis of elements and materials, taking into account their characteristics, as objects of research, allowing to evaluate the processes of transformation and transfer.

Learning Outcomes:

Learning Outcomes in EP (LOP)

LOP 6 Analyzes the peculiarities of teaching natural subjects, assesses the effectiveness of innovations and scientific research from a critical point of view

LOP 7 Able to creatively apply knowledge in relevant areas of chemical research (nanotechnology, kinetics of electronic processes, heterocyclic compounds, etc.) in the educational process.

Learning Outcomes in Course (LOC)

LOD 1 – Has an idea of the features of biological systems and drugs as objects of analysis.

LOD 2 -Can assess the possibility of using various methods of elemental and material analysis to study the chemical composition of biologically active substances.

LOD 3 - Knowledge and ability to apply methods for assessing the reliability of analysis results; owns methods of control, accounting and elimination of system errors due to the complex chemical composition and other features of the research object.

LOD 4 - The acquired skills of preparation for the analysis of the studied objects, depending on the applied instrumental method and research problem.

LOD 5 – He mastered the skills of practical application of modern instrumental methods for the analysis of elements (atomic emission spectrometry with inductively coupled plasma) and materials (capillary electrophoresis and high performance liquid chromatography) associated with the study of the composition of drugs and the effect of biologically active substances on living organisms.

LOD 6 – Understands the principles of organizing and managing scientific groups.

LOD7– Basics of business communication, interpersonal skills, the ability to work in a research team.

Post requisites: no

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2 CYCLE OF PROFILING DISCIPLINE

Component of choice 1

Course: **Educational technologies and methodology of teaching general chemistry**

Intensity of the Course: 5 academic credits

Module Code: **MDCh-3**

Module Name: **The main directions of modern chemistry**

Prerequisites: Solving complex problems in chemistry

Purpose: To teach to solve problems of a complex level

Short Description: Technique for solving problems of an increased level of complexity: calculations by chemical formulas. Calculations by equations of chemical reactions. Problems on the equations of parallel reactions. Physicochemical calculations. Derivation of formulas of chemical compounds in various ways. Derivation of the formula of a substance based on the mass fraction of elements. Derivation of the molecular formula of a substance from the relative density of its vapors and mass, volume or amount of substance of combustion products. Derivation of the formula of a substance based on the general formula of a homologous series of organic compounds. Methodology for solving combined problems. Non-standard and Olympiad problems.

Learning Outcomes:

Learning Outcomes in EP (LOP)

LOP 4 - Organizes an active independent activity for the development of students' mental abilities, is able to use and develop the theoretical foundations of traditional and new branches of chemistry in solving professional problems.

LOP 6 -Analyzes the peculiarities of teaching natural subjects, assesses the effectiveness of innovations and scientific research from a critical point of view

Learning Outcomes in Course (LOC)

LOD 1 – Develops the types of reactions used in inorganic synthesis;

LOD 2 - Mastering the methods of physical and chemical analysis of inorganic compounds;

LOD 3 – Knows the main types of inorganic materials used in production;

LOD4 – Organizes reaction methods in inorganic synthesis;

LOD 5 – Organizes methods of reactions in inorganic synthesis;

LOD 6 – Knows how to work on inorganic synthesis;

LOD 7 – In practice, uses the methods of physicochemical analysis of inorganic compounds.

Post requisites: Chemistry tasks for high school

Component of choice 2

Course: **Methods of solving problems in high level of chemistry**

Intensity of the Course: 5 academic credits

Module Code: **MDCh-3**

Module Name: **The main directions of modern chemistry**

Prerequisites: Solving complex problems in chemistry

Purpose: To teach to solve problems of a complex level

Short Description: Methods of solving problems of high complexity: calculations by chemical formulas. Calculations of chemical reaction equations. Tasks on the equations of parallel reactions. Physical-chemical calculations. Derivation of the formulas of chemical compounds in a variety of ways. Deduce the formula of a substance based on the mass percentage of the elements. Derivation of the

molecular formula of a substance by the relative density of its vapors and the mass, volume or quantity of the substance of the combustion products. Derivation of the substance formula on the basis of the General formula of the homological series of organic compounds. Methods of solving combined problems. Non-standard and Olympiad tasks.

Learning Outcomes:

Learning Outcomes in EP (LOP)

LOP 3 - He knows the scientific and methodological foundations of chemistry education, organizational forms and principles of teaching and pedagogical control in colleges and universities.
LOP 6 - Analyzes the peculiarities of teaching natural subjects, assesses the effectiveness of innovations and scientific research from a critical point of view

Learning Outcomes in Course (LOC)

LOD 1 – Develops the types of reactions used in inorganic synthesis;

LOD 2 - Mastering the methods of physical and chemical analysis of inorganic compounds;

LOD 3 – Knows the main types of inorganic materials used in production;

LOD4 – Organizes reaction methods in inorganic synthesis;

LOD 5 – Organizes methods of reactions in inorganic synthesis;

LOD 6 – Knows how to work on inorganic synthesis;

LOD 7 – In practice, uses the methods of physicochemical analysis of inorganic compounds.

Post requisites: no

Component of choice 3

Course: **Chemistry tasks for high school**

Intensity of the Course: 6 academic credits

Module Code: **MDCh-3**

Module Name: **The main directions of modern chemistry**

Prerequisites: Solving complex problems in chemistry

Purpose: To teach to solve problems of a complex level

Short Description: Algorithms for solving computational problems. Calculations without chemical reactions. Additive mixtures. Determining the formula of a chemical compound in is clearly specified quantitative parameters. The calculations using equations of chemical reactions. Determination of the formula of the substance by quantitative data on its transformations. The calculation of one equation of the reaction. A simple proportion with explicit quantitative parameters. Excess (lack) of one of the reagents. Implicitly defined quantitative parameters. Calculations using the difference in mass of reagents and reaction products. Comparison of quantitative data of several processes.

Learning Outcomes:

Learning Outcomes in EP (LOP)

LOP 3 - He knows the scientific and methodological foundations of chemistry education, organizational forms and principles of teaching and pedagogical control in colleges and universities.
LOP 6 - Analyzes the peculiarities of teaching natural subjects, assesses the effectiveness of innovations and scientific research from a critical point of view

Learning Outcomes in Course (LOC)

LOD 1 – Develops the types of reactions used in inorganic synthesis;

LOD 2 - Mastering the methods of physical and chemical analysis of inorganic compounds;

LOD 3 – Knows the main types of inorganic materials used in production;

LOD4 – Organizes reaction methods in inorganic synthesis;
LOD 5 – Organizes methods of reactions in inorganic synthesis;
LOD 6 – Knows how to work on inorganic synthesis;
LOD 7 – In practice, uses the methods of physicochemical analysis of inorganic compounds.
Post requisites: no

Component of choice 4

Course: **Modern methodological foundations of teaching physical and colloidal chemistry**
Intensity of the Course: 5 academic credits
Module Code: **MDCh-3**
Module Name: **The main directions of modern chemistry**
Prerequisites: MTCh 5206.1 Methods for Teaching Chemistry.
Purpose: To acquaint undergraduates with scientific, technical, pedagogical information systems, to teach them to independently search for the necessary information using new information technologies.
Short Description: Introduction. Chemical thermodynamics. Elements of statistical thermodynamics. Phase equilibrium and physical-chemical analysis. Solutions of nonelectrolytes. Electrolyte solution. Chemical kinetics. Catalysis. Homogeneous, heterogeneous catalysis. Theories of heterogeneous catalysis. Structural and mechanical properties of disperse systems. Colloidal surfactants. The nature and some properties of solutions of the HMS.*Learning Outcomes:*
Learning Outcomes in EP (LOP)
LOP 6- Analyzes the peculiarities of teaching natural subjects, assesses the effectiveness of innovations and scientific research from a critical point of view
LOP 8 - He owns a system of professional and general scientific knowledge that allows him to substantiate his position in the course of scientific discussions, to present the results obtained in research in the form of reports, scientific publications and patents.
Learning Outcomes in Course (LOC)
LOD 1 - Knows modern theoretical aspects of chemical science;
LOD 2– Knows how to conduct research at the university;
LOD 3 - Has mastered chemical and instrumental methods of analysis.
LOD 4 - Knows the theoretical foundations of experience and practical application.
LOD 5 - Studied methods of conducting experiments in chemistry
LOD 6 - Competently performs scientific and practical work.
LOD 7- Carries out professional scientifically grounded work.
Post requisites: ZhMHEZhA 6304 Methodology for conducting chemical experiments at school.

Component of choice 5

Course: **Methods of teaching physical and colloidal chemistry**
Intensity of the Course: 5 academic credits
Module Code: **MDCh-3**
Module Name: **The main directions of modern chemistry**
Prerequisites: MTCh 5206.1 Methods for Teaching Chemistry.
Purpose: To acquaint undergraduates with scientific, technical, pedagogical information systems, to teach them to independently search for the necessary information using new information technologies.
Short Description: Chemical thermodynamics. Elements of statistical thermodynamics. Phase equilibrium and physical-chemical analysis. Solutions of nonelectrolytes. Electrolyte solution. Chemical

kinetics. Catalysis. Homogeneous, heterogeneous catalysis. Theories of heterogeneous catalysis. Structural and mechanical properties of disperse systems. Colloidal surfactants. The nature and some properties of solutions of the HMS.*Learning Outcomes:*

Learning Outcomes in EP (LOP)

LOP 4 - Organizes an active independent activity for the development of students' mental abilities, is able to use and develop the theoretical foundations of traditional and new branches of chemistry in solving professional problems.

LOP 7 - Able to creatively apply knowledge in relevant areas of chemical research (nanotechnology, kinetics of electronic processes, heterocyclic compounds, etc.) in the educational process.

Learning Outcomes in Course (LOC)

LOD 1 - Knows modern theoretical aspects of chemical science;
LOD 2– Knows how to conduct research at the university;
LOD 3 - Has mastered chemical and instrumental methods of analysis.
LOD 4 - Knows the theoretical foundations of experience and practical application.
LOD 5 - Studied methods of conducting experiments in chemistry
LOD 6 - Competently performs scientific and practical work.
LOD 7- Carries out professional scientifically grounded work.

Post requisites: no

Component of choice 6

Course: **Methods for using interactive methods of teaching chemistry at the university**

Intensity of the Course: 6 academic credits

Module Code: **MDCh-3**

Module Name: **The main directions of modern chemistry**

Prerequisites: MMETGICh 5301 Methodology and modern educational technologies of General and Inorganic chemistry

Purpose: is to familiarize students with the scientific and technical, pedagogical information system, to teach them how to find the necessary information with the help of new information technologies.To acquaint undergraduates with scientific, technical, pedagogical information systems, to teach them to independently search for the necessary information using new information technologies.

Short Description: Basic forms and methods of interactive learning. Interactive approach. Principles and methods of building an interactive type of educational process at the University. Individualization. Flexibility. Electivity. Contextual approach. Modern interactive teaching methods. Problem-situational teaching methods. Round table, discussion, debate. Brainstorming, brainstorming, brainstorming. Business and role play. Case-study (analysis of specific situations, situational analysis). Master class. Videoconference.

Learning Outcomes:

Learning Outcomes in EP (LOP)

LOP 5 - He possesses the skills of conducting scientific and experimental research in all branches of chemistry and methods of teaching the subject.

LOP 6 - Analyzes the peculiarities of teaching natural subjects, assesses the effectiveness of innovations and scientific research from a critical point of view

Learning Outcomes in Course (LOC)

LOD 1 - Knows modern theoretical aspects of chemical science;
LOD2– Knows how to conduct research at the university;
LOD 3 - Has mastered chemical and instrumental methods of analysis.

LOD 4 - Knows the theoretical foundations of experience and practical application.
LOD5 - Studied methods of conducting experiments in chemistry
LOD6 - Competently performs scientific and practical work.
LOD7- Carries out professional scientifically grounded work.
Post requisites: General chemistry and teaching methods

Component of choice 7

Course: **General chemistry and teaching methods**
Intensity of the Course: 6 academic credits
Module Code: **MDCh-3**
Module Name: **The main directions of modern chemistry**
Prerequisites: MTCh 5206.1 Methods for Teaching Chemistry.
Purpose: To acquaint undergraduates with scientific, technical, pedagogical information systems, to teach them to independently search for the necessary information using new information technologies.
Short Description: The subject and objectives of the course. Modern problems of teaching and learning. Training system: goals, content, methods, organizational forms, means, control of assimilation and diagnostics of the formed knowledge. The principles of teaching. Methods of teaching chemistry. Organizational forms of teaching chemistry. Means of teaching chemistry. Assessment and diagnostics of chemical knowledge qualities. Methods of studying the most important topics of General chemistry.
Learning Outcomes:
Learning Outcomes in EP (LOP)
LOP 5 - Possesses the skills of conducting scientific and experimental research in all branches of chemistry and methods of teaching the subject
LOP 8 - He owns a system of professional and general scientific knowledge that allows him to substantiate his position in the course of scientific discussions, to present the results obtained in research in the form of reports, scientific publications and patents.
Learning Outcomes in Course (LOC)
LOD 1 - Knows modern theoretical aspects of chemical science;
LOD 2– Knows how to conduct research at the university;
LOD 3 - Has mastered chemical and instrumental methods of analysis.
LOD 4 - Knows the theoretical foundations of experience and practical application.
LOD 5 - Studied methods of conducting experiments in chemistry
LOD 6 - Competently performs scientific and practical work.
LOD 7- Carries out professional scientifically grounded work.
Post requisites: no

Component of choice 8

Course: **Methodological aspects of teaching the course "Physical Research Methods"**
Intensity of the Course: 6 academic credits
Module Code: **MDCh-3**
Module Name: **The main directions of modern chemistry**
Prerequisites: MMETGICh 5301 Methodology and modern educational technologies of General and Inorganic chemistry
Purpose: is to familiarize students with the scientific and technical, pedagogical information system, to teach them how to find the necessary information with the help of new information

technologies.To acquaint undergraduates with scientific, technical, pedagogical information systems, to teach them to independently search for the necessary information using new information technologies.

Short Description: Methodology and methods of scientific research. Characteristics and classification of physical and chemical methods of analysis. Organization of the research process. Methods of studying the topic: "Chromatographic and spectroscopic methods of analysis". Methods of qualitative chromatographic analysis. Sampling and sample preparation. Methodological aspects of the study: optical methods

Learning Outcomes:

Learning Outcomes in EP (LOP)

LOP 5- He possesses the skills of conducting scientific and experimental research in all branches of chemistry and methods of teaching the subject.

LOP 6- Analyzes the peculiarities of teaching natural subjects, assesses the effectiveness of innovations and scientific research from a critical point of view

Learning Outcomes in Course (LOC)

LOD 1 - Knows modern theoretical aspects of chemical science;

LOD 2– Knows how to conduct research at the university;

LOD 3 - Has mastered chemical and instrumental methods of analysis.

LOD 4 - Knows the theoretical foundations of experience and practical application.

LOD 5 - Studied methods of conducting experiments in chemistry

LOD 6 - Competently performs scientific and practical work.

LOD 7- Carries out professional scientifically grounded work.

Post requisites: Kinetics of Electronic Processes

Component of choice 9

Course: **Kinetics of Electronic Processes**

Intensity of the Course: 6 academic credits

Module Code: MDMCh-3

Module Name: **The main directions of modern chemistry**

Prerequisites: MMPhChA 5302 Modem methods of physical and chemical analyzes

Purpose: To acquaint undergraduates with scientific, technical, pedagogical information systems, to teach them to independently search for the necessary information using new information technologies.

Short Description: Polarization and overvoltage. Double electric layer. Electrocapillary phenomena. Diffusion kinetics. Slow-discharge theory. Kinetics of complex electrochemical reactions. Electrochemical reactions with consecutive transfer of electrons. Kinetics of electrode processes involving metal complexes. Oxidation-reduction as an electronic process. Electrochemical processes in a slow chemical reaction

Learning Outcomes:

Learning Outcomes in EP (LOP)

LOP 4 - Organizes an active independent activity for the development of students' mental abilities, is able to use and develop the theoretical foundations of traditional and new branches of chemistry in solving professional problems.

LOP 7 - Able to creatively apply knowledge in relevant areas of chemical research (nanotechnology, kinetics of electronic processes, heterocyclic compounds, etc.) in the educational process.

Learning Outcomes in Course (LOC)

LOD 1 - Knows modern theoretical aspects of chemical science;

LOD 2– Knows how to conduct research at the university;

LOD 3 - Has mastered chemical and instrumental methods of analysis.

LOD 4 - Knows the theoretical foundations of experience and practical application.
LOD 5 - Studied methods of conducting experiments in chemistry
LOD 6 - Competently performs scientific and practical work.
LOD 7- Carries out professional scientifically grounded work.
Post requisites: no

Component of choice 10

Course: **Methodology and technology of scientific research**

Intensity of the Course: 6 academic credits

Module Code: **BSR-4**

Module Name: **Fundamentals of scientific research**

Prerequisites: MTCh 5206.1 Methods for Teaching Chemistry.

Purpose: To acquaint undergraduates with scientific, technical, pedagogical information systems, to teach them to independently search for the necessary information using new information technologies.

Short Description: The meaning and essence of scientific research. The classification of the Sciences. Relationship of the course with other disciplines. Differentiation and integration of science. Accelerated development of science. Methodological basis for determining the level of science in different countries. Level of development and main directions of scientific research in different countries of the world. Organization of science in Kazakhstan. Legislative and regulatory acts regulating the basis of research activities. Methodology and methodology of scientific research. The essence of the research methodology. Principles and problem of research.

Learning Outcomes:

Learning Outcomes in EP (LOP)

LOP 1- Demonstrates knowledge of philosophy and methodology of science, allowing to plan and design research and innovation in the field of chemistry education.
LOP 6 - Analyzes the peculiarities of teaching natural subjects, assesses the effectiveness of innovations and scientific research from a critical point of view

Learning Outcomes in Course (LOC)

LOD 1 - Knows modern theoretical aspects of chemical science;
LOD 2– Knows how to conduct research at the university;
LOD 3 - Has mastered chemical and instrumental methods of analysis.
LOD 4 - Knows the theoretical foundations of experience and practical application.
LOD 5 - Studied methods of conducting experiments in chemistry
LOD 6 - Competently performs scientific and practical work.
LOD 7- Carries out professional scientifically grounded work.
Post requisites: Fundamentals of Scientific Research

Component of choice 7

Course: **Nanomaterials and nanotechnology**

Intensity of the Course: 5 academic credits

Module Code: **BSR-4**

Module Name: **Fundamentals of scientific research**

Prerequisites: RSTV 5207.1 Reactivity of solids.

Purpose: Many fundamental crystallochemical concepts are widely used in theoretical, experimental and applied chemistry and are an important part of modern chemistry.

Short Description: Nanotechnology. Nanomaterial. Nano system. Nano diagnosis. Nanotechnology. The history of the development of nanotechnology. Prospects for the use of nanotechnology. Nanoparticles. Methods for producing nanoparticles. Mechanical method. Physical method. Chemical methods: co-deposition method, Sol gel method, reduction and thermal decomposition method, hydrolysis method, thermolysis, pulsed laser methods. Properties of nanoparticles. Application of nanoparticles.*Learning Outcomes:*

Learning Outcomes in EP (LOP)

Learning Outcomes in Course (LOC)

LOP 3 -He knows the scientific and methodological foundations of chemistry education, organizational forms and principles of teaching and pedagogical control in colleges and universities.

LOP 6 - Analyzes the peculiarities of teaching natural subjects, assesses the effectiveness of innovations and scientific research from a critical point of view

Learning Outcomes in Course (LOC)

LOD 1 – Knows the basics of nanotechnology.

LOD 2 - Predicts the stability and physicochemical properties of nanoobjects.

LOD 3- Guides in the modern literature on nanotechnology.

LOD 4 - To independently set tasks for the creation or practical application of nanoobjects.

LOD 5 - He is oriented in the methods of obtaining and studying nanostructures.

LOD 6 - Understands the mechanism of physical and chemical dimensional effects.

Post requisites: Nanochemistry

Component of choice 7

Course: **Nanochemistry**

Intensity of the Course: 5 academic credits

Module Code: **BSR-4**

Module Name: **Fundamentals of scientific research**

Prerequisites: RSTV 5207.1 Reactivity of solids.

Purpose: Many fundamental crystallochemical concepts are widely used in theoretical, experimental and applied chemistry and are an important part of modern chemistry.

Short Description: Objects of Nano chemistry research. Stages of development and application of Nano chemistry. Classification of objects of Nano chemistry. The main types of Nano objects and Nano systems based on them. Fullerene. Carbon nanotubes. Objects of supramolecular chemistry. Inorganic nanomaterial. Whiskers. Manganite. Methods of synthesis of nanostructured materials. Methods of synthesis of Nano crystalline powders. Gas-phase synthesis. Plasma-chemical synthesis. Production of Nano crystalline materials.

Learning Outcomes:

Learning Outcomes in EP (LOP)

LOP 4 - Organizes an active independent activity for the development of students' mental abilities, is able to use and develop the theoretical foundations of traditional and new branches of chemistry in solving professional problems.

LOP 5 -He possesses the skills of conducting scientific and experimental research in all branches of chemistr y and methods of teaching the subject.

Learning Outcomes in Course (LOC)

LOD 1 – Knows the basics of nanotechnology.

LOD 2 - Predicts the stability and physicochemical properties of nanoobjects.

LOD 3- Guides in the modern literature on nanotechnology.

LOD 4 - To independently set tasks for the creation or practical application of nanoobjects.

LOD 5 - He is oriented in the methods of obtaining and studying nanostructures.
LOD 6 - Understands the mechanism of physical and chemical dimensional effects.
LOD 7- Knows the specifics of the behavior of a substance in the nanometer size range.

Post requisites: no