CATALOG OF ELECTIVE DISCIPLINES

6B05 - Natural Sciences, Mathematics and Statistics
(Code and classification of the field of education)

6B053 - Physical and chemical sciences
(Code and classification of the direction of training)

0530
(Code in the International Standard Classification of Education)

B053 - Chemistry
(Code and classification of the educational program group)

6B05301 - Chemistry
(Code and name of the educational program)

bachelor
(Level of preparation)

set of 2023

Semey 2023

Developed
By the Academic Committee of the OP
The head of the AK Nesipkhan Gulnur Nesiptaevna
EP Manager Nurgaliev Nurzhan Nurlybekovich

Reviewed
At the meeting of the Quality Assurance Commission of the
Faculty of Engineering and Technology
Recommended for approval by the Academic Council of the University
Protocol № 4/6 10.04.2023 y.
Chairman of the Commission on Quality Assurance Abdilova G.B.

Approved
at the meeting of the Academic Council of the University
Protocol № 5 21.04.2023.
Chairman of the Academic Council Oralkanova I.A.

Undergraduate practice

Discipline cycle	Profiling discipline
Course	4
Credits count	8
Knowledge control form	Total mark on practice

Short description of discipline
The purpose of pre-diploma practice: a detailed study of the organizational structure of the enterprise and its current management system, process, equipment operation, control, issues of life safety, economic production indicators, selection of necessary materials on the topic of graduation design (work).

Purpose of studying of the discipline
a detailed study of the organizational structure of the enterprise and its current management system, process, equipment operation, control, issues of life safety, economic production indicators, selection of necessary materials on the topic of graduation design (work)

Learning Outcomes
ON5 Use knowledge of applied chemistry in professional activities
ON9 To master scientific thinking and the ability to solve problems in the scientific and industrial direction

Learning outcomes by discipline
1) Connect the theoretical part of the work with production when writing a thesis or project
2) Determine the development of personal qualities in professional activities and the scientific environment
3) Solve problems in the activities of the organization and offer ways to solve them

Prerequisites
Basic and profile disciplines of the EP Methods of scientific research in the field of chemistry

Postrequisites
Final examination

Production practice III

Discipline cycle	Profiling discipline
Course	4
Credits count	8
Knowledge control form	Total mark on practice

Short description of discipline
The practice is aimed at consolidating the theoretical knowledge of specialized disciplines in production or a research center.
Examines the activities of the organization and its main indicators. Teaches hands-on experience in chemical production.Uncovers scores and proposes technology-based solutions to improve organizational performance. It gives the student the opportunity to qualitatively prepare for writing and defending his final qualifying work.

Purpose of studying of the discipline
a detailed study of the organizational structure of the enterprise and its current management system, process, equipment operation, control, issues of life safety, economic production indicators, selection of necessary materials on the topic of graduation design (work)

Learning Outcomes
ON5 Use knowledge of applied chemistry in professional activities
ON9 To master scientific thinking and the ability to solve problems in the scientific and industrial direction

Learning outcomes by discipline
1) Show theoretical knowledge in core disciplines in production
2) Prepare for practical experience in a chemical production or research center.
3) Offer technologically sound solutions aimed at improving the efficiency of the organization

Prerequisites
Basic and profile disciplines of the EP Production practice II

Postrequisites
Final examination

Analytical chemistry of trace amounts

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course deals with the problem of trace analysis. He studies the basic terms and concepts, the principles of physico-chemical methods for the analysis of trace amounts. Forms an idea about the analytical signal and control experience. Teaches you how to choose methods of determination and how to combine methods for determining ultra-low concentrations and ultra-low doses. It reveals the role of trace elements in scientific research, the role of the matrix in determining traces, the role of losses and pollution in determining low concentrations.

Purpose of studying of the discipline
Obtaining students ` knowledge about the principles and techniques of analyzing trace amounts of substances.

Learning Outcomes
ON5 Use knowledge of applied chemistry in professional activities
ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems

Learning outcomes by discipline
1) Describe the theoretical and practical foundations of physicochemical methods for the analysis of trace amounts of substances
2) Explain the role of analysis in scientific research

3) Select methods of analysis for determining trace concentrations of substances

Prerequisites

Analytical chemistry

Postrequisites

Basic and profile disciplines of the EP

Quantitative analysis in Inorganic Chemistry

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

This course examines the theoretical and practical foundations of quantitative analysis in inorganic chemistry. Considers the essence and features, areas of application of the main methods of quantitative analysis. He studies the metrological foundations of chemical analysis. Forms the concept of analysis errors and methods for their detection. Teaches the use and conduct of chemical analysis by gravimetric and titrimetric methods of inorganic substances for the control of various technological processes.

Purpose of studying of the discipline

Obtaining students ` knowledge of the theoretical foundations and methods of chemical quantitative analysis of inorganic substances

Learning Outcomes

ON5 Use knowledge of applied chemistry in professional activities
ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems

Learning outcomes by discipline

1) Describe the features and applications of quantitative analysis methods
2) Apply gravimetric and thyrimetric methods in the quantitative analysis of inorganic substances
3) Evaluate analysis errors by metrological calculations

Prerequisites

Analytical chemistry

Postrequisites

Basic and profile disciplines of the EP

The chemical quantitative analysis

Discipline cycle	Basic disciplines
Course	2
Credits count	5
Knowledge control form	Examination

Short description of discipline

This course examines the theoretical and practical foundations of chemical quantitative analysis and its applications: gravimetric, titrimetric analysis. Forms an idea of the metrological foundations of chemical analysis and statistical processing of analysis results. Teaches gravimetric analysis by stripping and settling methods. Reveals the essence of titrimetric analysis by studying the methods and methods of acid-base, redox titration, complex formation and precipitation.

Purpose of studying of the discipline

Students gain knowledge about the methods of chemical quantitative analysis, their theoretical foundations, as well as acquire the skills of laboratory experiments and the ability to draw theoretical conclusions based on the observed phenomena.

Learning Outcomes

ON5 Use knowledge of applied chemistry in professional activities
ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems

Learning outcomes by discipline

1) Describe methods for chemical quantitation, determination and separation
2) Suggest analysis schemes and analysis method
3) Apply instruments and equipment in analytical practice

Prerequisites

General chemistry Analytical chemistry

Postrequisites

Basic and profile disciplines of the EP

Titrimetric methods of analysis

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

This course covers titrimetric analysis, reaction requirements. Forms an idea about the methods of titration: methods of direct, reverse and substitution titration; method of pipetting and the method of individual portions. Teaches acid-base, redox titration, complexation and precipitation techniques. Reveals the essence of titration indicator errors. Learns the titrants used, indicators, titration conditions, and titrations in non-aqueous media.

Purpose of studying of the discipline

Measuring the volume of a reagent solution of a precisely known concentration consumed for a reaction with an analyte

Learning Outcomes

ON5 Use knowledge of applied chemistry in professional activities

ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems

Learning outcomes by discipline

1) Describe direct, back, substitution titration, pipetting and single-batch methods
2) Teach acid-base, redox, complexation and precipitation methods
3) Explain titrants, indicators, titration conditions, and non-aqueous titration

Prerequisites

Analytical chemistry Physical chemistry

Postrequisites

Basic and profile disciplines of the EP

Physical methods of research

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

This course studies the electron spectroscopy of complex molecules. Examines the basic concepts of vibrational spectroscopy, as well as rotational spectroscopy. Presents general information about vibrational- rotational spectroscopy and refractometry. Forms an understanding of spectroscopy in the radio frequency domain. Considers the main points and theoretical foundations of the method of nuclear gamma resonance and mass spectrometry. He studies the fundamentals of spectroscopy in the field of X-rays.

Purpose of studying of the discipline

Understanding the fundamentals, practical possibilities and limitations of the most important physical research methods for chemists, familiarity with their equipment and experimental conditions, the ability to interpret and correctly evaluate experimental data, including those published in the scientific literature

Learning Outcomes

ON5 Use knowledge of applied chemistry in professional activities
ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems

Learning outcomes by discipline

1) Describe the basics of spectroscopy in different fields
2) Choose research and analysis methods
3) Apply the methods of spectroscopy, refractometry, etc.

Prerequisites

Analytical chemistry Physical chemistry

Postrequisites

Basic and profile disciplines of the EP

Photometry in analytical practice

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

The course studies the types of reactions used in photometry. Considers the choice of the spectral region, the choice of reagent, solvent. Outlines the metrological characteristics of photometric analysis: sensitivity, reproducibility of photometric determinations, range of determined contents. Forms an idea about the choice of optimal conditions and the elimination of the influence of foreign components in photometric determinations. He studies the basics of absolute and differential photometric methods of determination and the extraction-photometric method.

Purpose of studying of the discipline

To study of the theoretical foundations of optical and spectral methods of analysis.

Learning Outcomes

ON5 Use knowledge of applied chemistry in professional activities
ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems

Learning outcomes by discipline

1) Describe the types of reactions used in photometry
2) Choose the optimal conditions and eliminate the influence of foreign components in photometric determinations
3) Apply extraction-photometric methods of determination

Prerequisites

Analytical chemistry Physical chemistry

Postrequisites

Basic and profile disciplines of the EP

Optical analysis methods

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

This course examines the origin of atomic spectra. Teaches the methods of atomic emission and atomic absorption spectroscopy, their essence and scope. Forms an idea about the occurrence of molecular spectra and methods of molecular spectroscopy. Reveals the

essence of photometry methods: photocolorimetry, spectrophotometry, nephelometry, turbidimetry. Considers the essence of the method for determining the concentration and their scope, advantages. Forms the concept of the method of luminescence spectroscopy and the definition of concentration, applicability and advantages of the method, as well as IR spectroscopy.

Purpose of studying of the discipline

Training in the theoretical foundations and practical application of optical analysis methods

Learning Outcomes

ON5 Use knowledge of applied chemistry in professional activities
ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems

Learning outcomes by discipline

1) Describe the occurrence of atomic spectra
2) Teach the methods of atomic emission and atomic absorption spectroscopy, their essence and scope.
3) Explain the essence of photometry methods: photocolorimetry, spectrophotometry, nephelometry, turbidimetry

Prerequisites

Analytical chemistry Physical chemistry

Postrequisites

Basic and profile disciplines of the EP

Electrochemical and optical methods of analysis

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

This course studies the basic concepts of electrochemical methods: conductometry, potentiometry, coulometry, voltammetry, polarography. Considers the theoretical foundations, the conditions for the analysis, the advantages and disadvantages of the methods. Forms the concept of atomic spectroscopic methods: atomic emission, atomic absorption, atomic fluorescence. Teaches the basic principles of molecular absorption spectroscopy techniques: photocolorimetry, spectrophotometry, turbidimetry, nephelometry. Considers the essence and features of luminescence spectroscopy, as well as vibrational spectroscopy

Purpose of studying of the discipline

Training in the theoretical foundations and practical application of electrochemical and optical analysis methods

Learning Outcomes

ON5 Use knowledge of applied chemistry in professional activities
ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems

Learning outcomes by discipline

1) Describe the main electrochemical and optical methods: conductometry, potentiometry, coulometry, voltammetry, polarography
2) Eeaches the conditions for the analysis of electrochemical and optical methods
3) Analyze the principles of molecular absorption spectroscopy methods: photocolorimetry, spectrophotometry, turbidimetry, nephelometry, etc.

Prerequisites

Analytical chemistry Physical chemistry

Postrequisites

Basic and profile disciplines of the EP

Electrochemical methods of analysis

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

This course examines electrode processes. Forms an idea of polarographic methods: classical, differential, normal pulse, differential pulse, alternating current polarography, polarography with fast potential sweep. Teaches the basic concepts of the potentiometry process, including direct and potentiometric titration. Reveals the essence of ionometry, as well as coulometry: amperostatic and potentiostatic. Considers questions on electrogravimetry and conductometry

Purpose of studying of the discipline

Training in the theoretical foundations and practical application of electrochemical analysis methods.

Learning Outcomes

ON5 Use knowledge of applied chemistry in professional activities
ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems

Learning outcomes by discipline

1) Describe the processes taking place on the electrodes, as well as polarographic methods: classical, differential, normal pulse, differential pulse, alternating current polarography, polarography with a fast potential sweep
2) Teach the basic concepts of the potentiometry process, including direct and potentiometric titration
3) Analyze the essence ionometry, as well as coulometry: amperostatic and potentiostatic, explain the issues of electrogravimetry and conductometry

Prerequisites

Analytical chemistry Physical chemistry

Postrequisites

Basic and profile disciplines of the EP

Spectroscopic methods of analysis

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course examines the theoretical and practical foundations of spectroscopic methods of analysis. He studies the classification of spectroscopic methods. It reveals the essence, advantages and disadvantages of the methods: electron spectroscopy of complex molecules, vibrational spectroscopy, rotational spectroscopy, vibrational-rotational spectroscopy, refractometry, spectroscopy in the radio frequency region, nuclear gamma resonance method, mass spectrometry, spectroscopy in the field of x-rays. Introduces the types and the main characteristics of the emission spectra. Teaches the technique of experiment of spectroscopic methods of analysis.
Purpose of studying of the discipline
Training in the theoretical foundations and practical application of spectroscopic analysis methods
Learning Outcomes
ON5 Use knowledge of applied chemistry in professional activities
ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems
Learning outcomes by discipline
1) Classify spectroscopy methods
2) Evaluate the advantages and disadvantages of various methods
3) Choose methods for performing a chemical experiment
Prerequisites
Analytical chemistry Physical chemistry
Postrequisites
Basic and profile disciplines of the EP

Chemical metrology

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course examines the theoretical and practical foundations of chemical metrology. He studies measurements, methods and means of ensuring their unity and the required accuracy. Describes the uncertainties of chemical analysis. Introduces the results and statistical foundations of processing measurement results, criteria for testing statistical hypotheses. Reveals the laws of distribution of observational results and random errors, as well as problems of error theory.
Purpose of studying of the discipline
To teaching students the basic methods of processing the results of quantitative chemical analysis
Learning Outcomes
ON5 Use knowledge of applied chemistry in professional activities
ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems
Learning outcomes by discipline
1) Describe measurements, methods and means of chemical metrology
2) Apply statistical processing and criteria for verifying measurement results
3) Evaluate the errors of chemical quantitative analysis
Prerequisites
Analytical chemistry Physical chemistry
Postrequisites
Basic and profile disciplines of the EP

Chromatographic separation methods and analysis

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course examines the theoretical and practical foundations of chromatography. Studying the classification of chromatographic methods. Reveals the essence, advantages and disadvantages of the theories of chromatography: the concept of "theoretical plates", the kinetic theory. Introduces the types and the main characteristics of chromatograms: width, height and area of the chromatographic peak. Teaches methods of planar chromatography: paper and thin layer. Considers the theoretical foundations and experimental technique of gas, liquid, adsorption, ion-exchange, preparative chromatography.
Purpose of studying of the discipline
Training in the theoretical foundations and practical application of chromatographic separation and analysis methods
Learning Outcomes
ON5 Use knowledge of applied chemistry in professional activities
ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems
Learning outcomes by discipline
1) Classify and compare chromatography methods
2) Choose a separation and analysis method
3) Apply classical chemical and chromatographic methods
Prerequisites

Analytical chemistry Physical chemistry

Postrequisites

Basic and profile disciplines of the EP

Heterocyclic compounds

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline forms an idea of the electronic and spatial structure, meaning, synthesis methods, chemical properties of monocyclic and condensed heterocycles. The conditions of aromaticity, nomenclature, structure, properties, methods of cyclization of five-membered and six-membered cycles with one and several heteroatoms are studied. The basics of organic synthesis of condensed heterocyclic compounds are considered. The questions of the biological significance of some compounds and the prospects of their use are revealed.

Purpose of studying of the discipline

To study of basic concepts and concepts of heterocycle chemistry

Learning Outcomes

ON4 Own the methods of synthesis, modification and technology for the production of chemicals and materials
ON5 Use knowledge of applied chemistry in professional activities

Learning outcomes by discipline

1) Suggest ways to use heterocyclic compounds
2) Show the practical significance of heterocyclic compounds
3) Apply the basics of organic synthesis of heterocyclic compounds for practical purposes

Prerequisites

Organic chemistry Mechanisms of organic reactions

Postrequisites

Basic and profile disciplines of the EP

Multi-core fused and unfused connection

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline develops a chemical understanding of multicore aromatic compounds with condensed and non-condensed nuclei. The issues of nomenclature, construction, chemical properties and methods of synthetic and industrial production are considered. The structure and properties of the aliphatic fragment, triphenylmethane, fuchsins, phthalimides and dyes based on them are studied. The properties and synthesis of naphthalene, anthracene, phenanthrene, anthraquinone dyes, carcinogenic hydrocarbons are described

Purpose of studying of the discipline

To study of the general regularities of the structure, nomenclature, methods of production, physical and chemical properties, industrial application of multi-core condensed and non-condensed compounds.

Learning Outcomes

ON4 Own the methods of synthesis, modification and technology for the production of chemicals and materials
ON5 Use knowledge of applied chemistry in professional activities

Learning outcomes by discipline

1) explain the chemical concept of polynuclear aromatic compounds with condensed and non-condensed nuclei
2) to study the structure and properties of condensed and non-condensed organic compounds
3) compare methods for the synthesis of condensed and non-condensed compounds

Prerequisites

Organic chemistry Mechanisms of organic reactions

Postrequisites

Petrochemistry

Stereochemistry of organic compounds

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

The course studies the basics of chirality, prochirality, configuration, conformation, as well as with auxiliary concepts and specific stereochemical terminology (chirality element, prochirality element, pseudochirality, enantiomers, diastereomers, epimers, racemic mixture, meso- form, top group relations. Considers the essence of asymmetric synthesis , stereoselectivity, stable conformation, conformational isomer, conformational transition, conformation occupancy.Studies the activation barrier of the conformational transition, axial and conformational energy of the substituent, anomeric effect.

Purpose of studying of the discipline

To study of the basic provisions of the stereochemistry of organic compounds

Learning Outcomes

ON5 Use knowledge of applied chemistry in professional activities

ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems

Learning outcomes by discipline

1) Evaluate the properties of organic compounds based on their spatial structure
2) Describe conformational and configurational transformations of organic compounds
3) Use instrumental methods of analysis to study the spatial structure of organic substances

Prerequisites

Organic chemistry Mechanisms of organic reactions

Postrequisites

Petrochemistry

Chemistry of organometallic compounds

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

The discipline gives an idea of organic derivatives of elements. The classification, structure and structure, fundamentals of preparation, reactivity, chemical properties of organoelement compounds - organometallic magnesium, organometallic copper, organometallic aluminum, organophosphorus compounds are considered. Organic compounds of transition metals are studied. The general problems of the chemistry of organoelement compounds, as well as the possibilities of their functionalization, are described. The issues of catalytic, biological properties of organoelement compounds are revealed.

Purpose of studying of the discipline

To study of the electronic structure, properties, reaction mechanisms organometallic compounds

Learning Outcomes

ON4 Own the methods of synthesis, modification and technology for the production of chemicals and materials
ON5 Use knowledge of applied chemistry in professional activities

Learning outcomes by discipline

1) Describe the theoretical foundations - classification, structure and properties of organoelement compounds
2) Apply the properties of organoelement compounds in practice
3) Suggest ways to obtain organoelement compounds

Prerequisites

Organic chemistry

Postrequisites

Basic and profile disciplines of the EP

Macromolecular Chemistry

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

Studies the criteria for the separation of high-molecular compounds and low-molecular substances, the most important properties of polymers, molecular mass characteristics of macromolecules, of polymer synthesis, the stages and kinetics of polymerization and polycondensation processes are considered. The physical and phase states of polymers are highlighted, thermomechanical curves of amorphous polymers are described, of the polymer dissolution process, the properties of polymer solutions, as well as the types of chemical transformations of macromolecules are discussed.

Purpose of studying of the discipline

To familiarization of students with the basics of polymer science, formation of knowledge about the chemistry, physics and physical chemistry of polymers and the most important areas of polymer application

Learning Outcomes

ON4 Own the methods of synthesis, modification and technology for the production of chemicals and materials
ON5 Use knowledge of applied chemistry in professional activities

Learning outcomes by discipline

1) Describe the criteria for distinguishing between high molecular weight compounds and low molecular weight substances, the most important properties of polymers
2) Formulate the basics of polymer synthesis, stages and kinetics of polymerization and polycondensation processes
3) Determine the features of the polymer dissolution process, the properties of polymer solutions

Prerequisites

Organic chemistry

Postrequisites

Basic and profile disciplines of the EP

Chemistry of Natural Compounds

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

This discipline studies natural compounds of inorganic and organic, as well as plant and animal origin. The types, structure, chemical

properties, significance, methods of isolation and biosynthesis of proteins, amino acids, alkaloids, pigments, flavonoids, phenolic compounds, enzymes, coenzymes, carbohydrates, vitamins are considered. The biological significance of natural compounds, ways of chemical modification, prospects for use in medicine, biotechnology, biology, pharmacy are described.

Purpose of studying of the discipline

To study of the chemical structure, chemical transformations, and biological functions of natural organic compounds

Learning Outcomes

ON4 Own the methods of synthesis, modification and technology for the production of chemicals and materials
ON5 Use knowledge of applied chemistry in professional activities

Learning outcomes by discipline

1) Describe the characteristics and properties of natural compounds
2) Isolate new compounds from natural sources
3) Determine the ways of chemical modification of natural compounds

Prerequisites

Organic chemistry

Postrequisites

Basic and profile disciplines of the EP

Analysis of minerals

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

Are being studied abundance of chemical elements in the earth`s crust, sampling methods, general characteristics and classification of mineral silicate raw materials. Are being considered characterization of the composition of carbonate rocks, sulfur-containing mineral raw materials, analysis of minerals and ores of ferrous metals, manganese and its ores, cobalt and its ores. Topics such as analysis of minerals and ores of non-ferrous metals, tin-bearing ores, analysis of minerals and ores of rare elements are covered.

Purpose of studying of the discipline

Studying the discipline is to form students` knowledge about the main stages of work on the technological assessment of mineral raw materials,
research skills and abilities

Learning Outcomes

ON4 Own the methods of synthesis, modification and technology for the production of chemicals and materials
ON5 Use knowledge of applied chemistry in professional activities

Learning outcomes by discipline

1) Describe the general characteristics of minerals and sampling methods
2) Explain the characteristics of the composition of carbonate rocks and sulfur-containing minerals, etc.
3) Apply methods for the analysis of minerals and ores of non-ferrous metals, as well as rare elements

Prerequisites

General chemistry

Postrequisites

Basic and profile disciplines of the EP

low-waste technology

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline

The problems of choosing energy carriers and raw materials with the maximum utilization factor in the process, the basic principles of creating non-waste industries and the requirements for them are studied. Are being considered issues of optimizing the production of the target product with variable characteristics of raw materials and energy carriers. The main issues are discussed territorial connection of enterprises on the example of the waste of one enterprise, which is a raw material for another enterprise.

Purpose of studying of the discipline

To understand the general patterns of organization of non-waste production of inorganic substances (inorganic acids, bases, salts, fertilizers, etc.) using chemical, petrochemical, mining and metallurgical waste.

Learning Outcomes

ON4 Own the methods of synthesis, modification and technology for the production of chemicals and materials
ON5 Use knowledge of applied chemistry in professional activities

Learning outcomes by discipline

1) Describe the basic principles of creating non-waste industries and the requirements for them.
2) Explain ways to optimize the production of the target product with variable characteristics of raw materials and energy carriers
3) Offer a solution to the problem of inter-industry communication using waste-free technology

Prerequisites

General chemistry

Postrequisites

Basic and profile disciplines of the EP

Fundamentals of technological processes in industry

Discipline cycle	Basic disciplines

Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
This discipline studies the most important technological concepts and definitions, patterns of movement of material and energy flows, economic, environmental requirements for a rational and low-waste production process. The importance of thermodynamic and kinetic laws for technology, technological methods, acceleration and deceleration of reactions is considered. are illuminated types and sources of energy, main types and resources of raw materials, enrichment of mineral raw materials, industrial and sanitary requirements for water.

Purpose of studying of the discipline
Teaching students the development and updating of new methods and techniques of analysis, the development of systems with chemical-technological processes.

Learning Outcomes
ON4 Own the methods of synthesis, modification and technology for the production of chemicals and materials
ON5 Use knowledge of applied chemistry in professional activities

Learning outcomes by discipline
1) Describe the most important technological concepts and definitions, patterns of movement of material and energy flows
2) Formulate thermodynamic and kinetic laws for technology, technological methods, acceleration and deceleration of reactions.
3) Determine the types and sources of energy, the main types and resources of raw materials, the enrichment of mineral raw materials

Prerequisites
General chemistry

Postrequisites
Basic and profile disciplines of the EP

Petrochemistry

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course examines the origin of oil and hydrocarbons. Forms an idea of the chemical, elemental, fractional and group composition of oil, oil products and hydrocarbons. Teaches the basic technological characteristics of oil. Reveals the essence of the classification of oil and oil products. Considers the concept of oil hydrocarbons. He studies heteroorganic compounds of oil and chemical- colloidal properties of oil. Teaches oil exploration methods and oil refining methods.

Purpose of studying of the discipline
To study of the formation of oil fraction, the chemical composition of oil and oil products, as well as the research methods of oil and oil products

Learning Outcomes
ON5 Use knowledge of applied chemistry in professional activities
ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems

Learning outcomes by discipline
1) Generalize the concepts of chemical, elemental, fractional and group composition of oil, oil products and hydrocarbons.
2) Explain the technological characteristics of oil and hydrocarbons
3) Choose technological processes used in industry for processing various oil and natural gas

Prerequisites
Organic chemistry Multi-core fused and unfused connection

Postrequisites
Basic and profile disciplines of the EP

Problems of complex use of petrochemical products

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course examines the origin and classification of oil and hydrocarbons. Considers the essence and features of physical properties, elemental composition, fractional composition of oil. He studies shruppovy and structural-group composition of the main oil products, methods for their determination. Forms the concept of elemental analysis of oil and oil products. Reveals the composition and performance properties of petroleum products and the basis for determining the main standardized indicators.

Purpose of studying of the discipline
Study of the integrated use of petrochemical products

Learning Outcomes
ON5 Use knowledge of applied chemistry in professional activities
ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems

Learning outcomes by discipline
1) Suggest methods for the rational use of oil and gas products
2) Describe the technology for obtaining HMS from oil
3) Suggest a solution to the problem of using raw materials

Prerequisites
Organic chemistry Multi-core fused and unfused connection
Postrequisites
Basic and profile disciplines of the EP

Modern technologies of deep processing of oil, gas and coal

Discipline cycle	Basic disciplines
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
The course studies the technology of gas processing, technology of oil and gas condensate preparation for processing. Considers the technology of oil and gas processing and production of commodity products. Studies the current state of development of the fuel and energy complex. Forms the concept of the basics of petrochemistry and petroleum products. Teaches the basics of chemical chemistry of fuel and oil, the theoretical foundations and technologies of physicochemical processes used in modern oil refineries.
Purpose of studying of the discipline
Study of fractional and elemental composition of oil, methods of oil production and refining
Learning Outcomes
ON5 Use knowledge of applied chemistry in professional activities
ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems
Learning outcomes by discipline
1) Describe the technology of oil refining and obtaining oil products
2) Assess the current state of development of the fuel and energy complex of Kazakhstan
3) Select the technology of physical and chemical processes used in deep oil refining
Prerequisites
Organic chemistry Multi-core fused and unfused connection
Postrequisites
Basic and profile disciplines of the EP

Fundamentals of Chemical Toxicology

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course examines the theoretical and practical foundations of chemical toxicology. Reveals the essence of the basic concepts and objects of chemical toxicology. Considers the classification of toxic substances. Forms an idea of the physicochemical and biochemical methods for the determination of toxic and potent substances. Teaches methods of detecting, identifying and neutralizing poisonous and highly active substances. He studies the meaning and characteristics of individual groups of toxic substances.
Purpose of studying of the discipline
To formation of the necessary knowledge on the methodology of systemic chemical and toxicological analysis, taking into account their professional activities in the field of chemical and environmental expertise
Learning Outcomes
ON5 Use knowledge of applied chemistry in professional activities
ON8 Use ecological knowledge in professional activity
Learning outcomes by discipline
1) Classify toxicants
2) Determine toxicants by physicochemical and biochemical methods
3) Evaluate the significance of individual groups of toxicants
Prerequisites
General chemistry
Postrequisites
Basic and profile disciplines of the EP

Solving problems of chemistry and chemical technology by computer software

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
The discipline studies computer programs MS Word, MS Power point, MS Excell, Microcal Origin, Chem Office, etc., used to solve problems in chemistry and chemical technology. Uses the capabilities of these programs for chemical calculations. Forms the skills of processing experimental data, calculating chemical reactions and technological processes, as well as modeling the chemical structures and properties of molecules using computer programs.
Purpose of studying of the discipline
To apply modern mathematical methods and physical phenomena and laws for mastering technological processes.
Learning Outcomes
ON 2 Apply mathematical methods and physical phenomena and laws in practice
ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems

Learning outcomes by discipline
1) Describe computer programs used to solve problems in chemistry and chemical technology
2) Apply the processing of experimental data, calculations of chemical reactions and technological processes
3) Offer modeling of chemical structures and properties of molecules using computer programs
Prerequisites
General chemistry
Postrequisites
Basic and profile disciplines of the EP

Chemical transformations of pollutants

Discipline cycle	Profiling discipline
Course	3
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course examines the chemistry of the main environmental pollution (atmospheric air, water, soil, plants and animals). Studies the chemical transformations of organic and inorganic pollutants in the environment, the impact of pollutants on flora and fauna. Reveals the chemical interactions of organisms with each other and with the environment. Teaches physical and chemical methods of studying and eliminating harmful effects on the environment.
Purpose of studying of the discipline
To development of knowledge and formation of a holistic view of the processes and phenomena of the physical and chemical interaction of pollutants with environmental components
Learning Outcomes
ON5 Use knowledge of applied chemistry in professional activities
ON8 Use ecological knowledge in professional activity
Learning outcomes by discipline
1) Describe the chemistry of transformations of inorganic and organic pollutants in the environment
2) Explain the effect of pollution and pollutants on non-living and living components of the natural environment
3) Apply physical and chemical methods to study and eliminate chemical pollutants
Prerequisites
General chemistry
Postrequisites
Basic and profile disciplines of the EP

Coordination chemistry

Discipline cycle	Profiling discipline
Course	4
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course describes complex compounds and their derivatives, studies their classification, nomenclature, stability, dissociation. Considers the main provisions of Werner`s coordination theory. He studies the structure of complex compounds and the theory of the structure of complex compounds. It reveals the essence of the theory of the crystal field, the theory of the field of ligands, and also considers ligands of strong and weak fields. Forms the basic concepts of the types of complex compounds with inorganic ligands, with organic ligands.
Purpose of studying of the discipline
To consider the basic concepts of the chemistry of coordination compounds; to study representatives of individual classes of coordination compounds, their nomenclature, parameters of chemical bonds in molecules, their geometric configuration, types of isomerism.
Learning Outcomes
ON5 Use knowledge of applied chemistry in professional activities
ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems
Learning outcomes by discipline
1) Describe the main characteristics of complex compounds and their derivatives
2) Explain the structure of complex compounds and the theory of the structure of complex compounds
3) Determine the types of complex compounds with inorganic ligands, with organic ligands
Prerequisites
Analytical chemistry
Postrequisites
Basic and profile disciplines of the EP

Chemical Synthesis

Discipline cycle	Profiling discipline
Course	4
Credits count	5
Knowledge control form	Examination

Short description of discipline
The course studies the most important sources of information about the ways of synthesis of inorganic and coordination compounds. Considers the theoretical foundations of inorganic synthesis. Teaches the basic methods of separating, concentrating and purifying

inorganic substances. Reveals chemical transport reactions. Forms an idea of reactions in the gas phase. Teaches solid phase synthesis methods and methods for the synthesis of anhydrous inorganic compounds. Reveals the production of simple substances, oxides, halides, hydrides, hydroxides, acids, salts.

Purpose of studying of the discipline

To study of methods and techniques of synthesis of inorganic substances

Learning Outcomes

ON5 Use knowledge of applied chemistry in professional activities
ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems

Learning outcomes by discipline

1) Describe the theoretical foundations of synthesis
2) Explain the main methods of separation, concentration and purification of inorganic and organic substances
3) Apply methods for obtaining simple substances, oxides, halides, hydrides, hydroxides, acids, salts.

Prerequisites

Analytical chemistry

Postrequisites

Basic and profile disciplines of the EP

Chemicals metal

Discipline cycle	Profiling discipline
Course	4
Credits count	5
Knowledge control form	Examination

Short description of discipline

This course examines and studies the position of metals in the periodic system and the features of the electronic structure of their atoms. Forms an idea of the physical and chemical properties of metals, their oxides and hydroxides of these metals. Teaches chemical and electrochemical corrosion of metals. Reveals the essence of protection against corrosion and the general characteristics of metals of the main subgroups of I-III groups of the periodic system of chemical elements of D.I. Mendeleev.

Purpose of studying of the discipline

To generate ideas about how metals chemical elements and simple substances like metals. Give the concept of metal links and metal lattice, some methods for producing metal

Learning Outcomes

ON5 Use knowledge of applied chemistry in professional activities
ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems

Learning outcomes by discipline

1) Describe the position of metals in the Periodic system of elements of D.I. Mendeleev and the features of the electronic structure of their atoms
2) Explain the physical and chemical properties of metals and their compounds.
3) Determine the chemical and electrochemical corrosion of metals

Prerequisites

Analytical chemistry

Postrequisites

Basic and profile disciplines of the EP

Analysis of inorganic substances

Discipline cycle	Profiling discipline
Course	4
Credits count	5
Knowledge control form	Examination and term work/Project

Short description of discipline

This course examines methods for isolating, separating and concentrating inorganic compounds. Teaches analytical methods of qualitative analysis: composition and purity, analysis of inorganic compounds. Forms an idea of the substances of special purity and the definition of impurity and alloying microelements in them. He studies the basics of the analytical method for the quantitative determination of inorganic substances. Considers the basics of physicochemical methods for the analysis of inorganic compounds.

Purpose of studying of the discipline

To study of the theoretical foundations of qualitative and quantitative analysis of inorganic substances

Learning Outcomes

ON5 Use knowledge of applied chemistry in professional activities
ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems

Learning outcomes by discipline

1) Describe the basics of the analytical method for the quantitative determination of inorganic substances
2) Apply methods for isolating, separating and concentrating inorganic compounds
3) Evaluate substances of high purity and determine the impurity and alloying elements in them

Prerequisites

Analytical chemistry

Postrequisites

Basic and profile disciplines of the EP

Analysis of organic substances

Discipline cycle	Profiling discipline
Course	4

Credits count	5
Knowledge control form	Examination and term work/Project

Short description of discipline
The course studies the methods of isolation, separation and concentration of organic compounds. Teaches analytical methods of qualitative analysis: composition and purity, analysis of organic compounds. Studies the elemental analysis of organic compounds for the description of C, H, O, S, N, P. Studies substances of high purity; determination of trace amounts of impurities in them. Considers analytical methods for the quantitative determination of organic substances. Reveals physico-chemical methods of analysis of organic compounds. IR spectroscopy of organic compounds.

Purpose of studying of the discipline
Training in the theoretical foundations of analysis organic substances

Learning Outcomes
ON5 Use knowledge of applied chemistry in professional activities
ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems

Learning outcomes by discipline
1)Describe analytical methods for the quantitative determination of organic substances
2) Apply analytical methods of qualitative chemical analysis: composition and purity of organic compounds
3) Compare substances of high purity and determine trace amounts of impurities in them.

Prerequisites
Analytical chemistry

Postrequisites
Basic and profile disciplines of the EP

The analysis of natural objects

Discipline cycle	Profiling discipline
Course	4
Credits count	5
Knowledge control form	Examination and term work/Project

Short description of discipline
This course examines the features of the analysis of natural objects: water, air, soil, geological objects, minerals, biological objects. Teaches the basic methods of sampling, preparing samples for analysis. Teaches methods of mineralization, concentration and separation, identification and quantification of components of natural objects. Studying the basics of determining the characteristics of soil, water. Examines the methods of automasing and biological analysis.

Purpose of studying of the discipline
training in the theoretical foundations of analysis and methods of chemical and physico-chemical analysis of various natural objects, working out the skills of laboratory experiments and theoretical conclusions based on the results of experimental observations.

Learning Outcomes
ON5 Use knowledge of applied chemistry in professional activities
ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems

Learning outcomes by discipline
1) Describe methods for analyzing natural objects
2) Apply sampling methods, sample preparation for analysis
3) Evaluate the methods of mineralization, concentration and separation, identification and quantitative determination of the components of natural objects

Prerequisites
Analytical chemistry

Postrequisites
Basic and profile disciplines of the EP

Analysis of oil and petroleum products

Discipline cycle	Profiling discipline
Course	4
Credits count	5
Knowledge control form	Examination

Short description of discipline
This course examines the theories and classification of oil. Considers the essence of physical properties, elemental composition, fractional composition of oil and oil products. He studies the basics of the group and structural-group composition of the main oil products, methods for their determination. Forms the concept of elemental analysis of oil and oil products. Studies the composition and performance properties of petroleum products. Teaches the definition of the main normalized indicators according to GOST.

Purpose of studying of the discipline
To acquire knowledge about the processes of oil formation, fractional and chemical composition of oil and oil products, quality requirements, methods of analysis of oil and oil products.

Learning Outcomes
ON5 Use knowledge of applied chemistry in professional activities
ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems

Learning outcomes by discipline
1) Determine the physical and operational properties of oil and oil products.
2) Analyze the elemental and fractional composition of oil and oil products
3) Evaluate the main normalized indicators of oil and hydrocarbons according to GOST.

Prerequisites

Analytical chemistry Petrochemistry

Postrequisites

Basic and profile disciplines of the EP

Catalytic processing of heavy oil fraction

Discipline cycle	Profiling discipline
Course	4
Credits count	5
Knowledge control form	Examination

Short description of discipline

The course studies the chemical composition and physical properties of oil. He studies the distillation of oil, the classification of commercial petroleum products. Forms the concept of catalytic processes, thermal processes of oil refining and heavy oil fractions. He studies the theory and practice of hydrocatalytic processes for the processing of petroleum fractions. Teaches the basics of refinery gas processing. Considers the essence of the fundamentals of oil production technology. Reveals industrial schemes of modern oil refineries.

Purpose of studying of the discipline

Study of the regularity of the processing of heavy oil by the catalytic method

Learning Outcomes

ON5 Use knowledge of applied chemistry in professional activities
ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems

Learning outcomes by discipline

1) Choose catalysts for oil refining
2) Describe catalytic processes for processing fuel oil, tar
3) Analyze industrial schemes of modern oil refineries

Prerequisites

Analytical chemistry Petrochemistry

Postrequisites

Basic and profile disciplines of the EP

Utilization of sulfur and sulfur-organic compounds of oil

Discipline cycle	Profiling discipline
Course	4
Credits count	5
Knowledge control form	Examination

Short description of discipline

This course examines the theoretical and practical methods of utilization of sulfur and organosulfur compounds of oil. Learns the basic properties of sulfides, sulfoxides and sulfones and how to use them. Forms the concept of the chemistry of reactions, the main types and mechanism of action of catalysts. Teaches the basics of oil refining and petrochemical synthesis knowing the main types of sulfur compounds that make up oil, as well as ways to dispose of them.

Purpose of studying of the discipline

Have a basic understanding of the disposal and further use of sulfur compounds of oil

Learning Outcomes

ON5 Use knowledge of applied chemistry in professional activities
ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems

Learning outcomes by discipline

1) Propose optimal methods for disposal from oil
2) Describe the properties of organosulfur compounds in oil
3) Recommend ways to remove organosulfur compounds from oil and petroleum products

Prerequisites

Analytical chemistry Petrochemistry

Postrequisites

Basic and profile disciplines of the EP

Radiation Chemistry

Discipline cycle	Basic disciplines
Course	4
Credits count	5
Knowledge control form	Examination

Short description of discipline

This course studies high energy chemistry, chemical processes caused by the action of ionizing radiation on matter. Reveals the basic concept of the ionizing ability of electromagnetic radiation (synchrotron radiation, X-rays, γ-radiation) and acceleration flows. Considers unusual chemical processes that are impossible with traditional chemical methods. Teaches the main points of ionizing radiation and the processes occurring in the irradiated environment.

Purpose of studying of the discipline

The study of the phenomenon of radioactivity, the principles of RB, methods of protecting the environment from radioactive pollutants

Learning Outcomes

ON5 Use knowledge of applied chemistry in professional activities
ON8 Use ecological knowledge in professional activity

Learning outcomes by discipline

1) Describe high energy chemistry and chemical processes caused by the action of ionizing radiation on matter
2) Determine the ionizing ability of electromagnetic radiation
3) Explain the main characteristics of ionizing radiation and processes occurring in the irradiated environment

Prerequisites

Ecological Chemistry

Postrequisites

Basic and profile disciplines of the EP

Man-made systems and environmental risk

Discipline cycle	Basic disciplines
Course	4
Credits count	5
Knowledge control form	Examination

Short description of discipline

The course studies the anthropogenic impact on the environment. Reveals the basics of ecotoxicants and methods for assessing their impact. Considers diagnostics and chemical-ecological control of environmental objects. Forms an idea of the main directions and methods for combating environmental pollution. Teaches methods of wastewater treatment, atmosphere, waste disposal. Studying the basics of the theory of dangers, classification and levels of the scale of dangers.

Purpose of studying of the discipline

To study of modern conceptual frameworks and methodological approaches to sustainable human interaction with the natural environment and safe functioning of technological systems

Learning Outcomes

ON6 Apply knowledge of the basics of instrumental chemistry to solve scientific and applied problems
ON8 Use ecological knowledge in professional activity

Learning outcomes by discipline

1) Describe the state of technogenic and anthropogenic impacts on the environment
2) Explain the essence of diagnostics and chemical and environmental control of environmental objects
3) To form an idea of the main directions and methods for combating environmental pollution

Prerequisites

Ecological Chemistry

Postrequisites

Basic and profile disciplines of the EP

Chemistry of environmental objects and rare metal raw materials

Discipline cycle	Basic disciplines
Course	4
Credits count	5
Knowledge control form	Examination

Short description of discipline

The course studies the chemistry of the main environmental pollution (atmosphere, water, soil, plants). Forms an idea of the chemical transformation of pollutants in the environment and the impact of pollutants on flora and fauna, chemical interactions of organisms with each other and with the environment. Studies the migration and transformation of all chemical compounds. Teaches the basic methods of eliminating harmful environmental impacts.

Purpose of studying of the discipline

Study of changes in the chemical composition of the environment and prediction of possible environmental consequences on their basis, the method of processing, decomposition and separation of rare-metal raw materials

Learning Outcomes

ON5 Use knowledge of applied chemistry in professional activities
ON8 Use ecological knowledge in professional activity

Learning outcomes by discipline

1) Describe the chemistry of the main pollution of environmental objects
2) Explain the migration of rare metal chemical compounds
3) Evaluate the main methods of eliminating the harmful effects on the environment

Prerequisites

Ecological Chemistry

Postrequisites

Basic and profile disciplines of the EP