



## 2. CONTENT OF THE EDUCATIONAL PROGRAM

### 2.1 Description of Modules

№	Module name	Academic Credits	Number and name of discipline	Academic credits of discipline	Cycle/ Component of the Discipline
	<b>ISE-1</b> Integration of science and education	16	<b>ISE 501</b> History and philosophy of science	4	CC/UC
			<b>ISE 502</b> Foreign language (professional)	4	CC/UC
			<b>ISE 503</b> Higher School Pedagogy	4	CC/UC
			<b>ISE 504</b> Psychology of management	4	CC/UC
2	<b>AMCh-2</b> Actual aspects modern chemistry	15	1) Selected chapters in inorganic chemistry	5	MC/UC
			2) Theoretical inorganic chemistry		
			1) Modern organic chemistry	5	MC/UC
			2) Heterocyclic compounds		
			1) Modern analytical chemistry	5	MC/UC
			2) Selected Chapters of Analytical Chemistry		
3	<b>MDMCh-3</b> The main directions of modern chemistry	31	1) Educational technologies and methodology of teaching general chemistry	5	CC/UC
			1) Technique for solving problems in chemistry of an advanced level	5	MC/UC
			2) Chemistry tasks for high school		
			1) Scientific and methodological foundations of organic chemistry and the Navy	5	MC/UC
			2) Physics and chemistry of polymers		
			1) Modern methodological foundations of teaching physical and colloidal chemistry	5	MC/UC
			2) Methods of teaching physical and colloidal chemistry		
			1) Methodology for using interactive methods of teaching chemistry at a university	5	MC/UC
			2) General chemistry and teaching methods		
			1) Methodological aspects of teaching the course	6	MC/UC
2) "Physical research methods" Kinetics of Electronic Processes					
4	<b>BSR-4</b> Fundamentals of Research Methodology	12	1) Research methodology and technology	7	CC/UC



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			1) Nanomaterials and nanotechnology	6	MC/UC
			2) Nanochemistry		MC/UC
5	<b>RW</b> Research work	24	Undergraduate research work, including internships and the implementation of a Master's thesis (MRW)	24	RW
		10	RW 6.01 Pedagogical practice	10	RW
		4	RW 6.02 Research practice	4	
6	Final certification	8	Registration and defense of the Master's thesis (RDMT)	8	FC
	Final	120		120	



## 2.2 Information about Disciplines

№	Name of Discipline	Academic Credits	Short Description of the Discipline (30-50 words)	Teaching Methods	Formed Learning Outcomes	Assessment Methods
<b>Cycle of Core Courses</b> <i>University Component</i>						
<p><b>ISE-1 integration of Science and education module description:</b> The disciplines of the module are aimed at learning new achievements in the field of psychological and Pedagogical Sciences, mastering the skills of oral and written communication in pedagogical various communication situations, observation and adaptation to the situation, taking into account the peculiarities of Physiology and psychology of adolescent children.</p> <p>Basic terminology in the field of vocabulary and chemistry, expressing the general scientific style of the profession for educational and professional purposes, analyzes languages, methods of annotation and compilation, as well as literature of a scientific and pedagogical nature.</p> <p>Uses knowledge of a foreign language to communicate and understand special texts.</p>						
1	<b>Higher School Pedagogy</b>	4	<b>Higher School Pedagogy-</b> Higher education in the modern world. Professional and pedagogical culture of a higher school teacher. Pedagogical communication. Theory of the pedagogical process of higher education. Didactics of higher education. Content of higher professional education. Managing the learning process. Methods and forms of higher school education. Theory of higher school education. Theory of scientific activity of the higher school. Pedagogical technologies. University management.	Distance learning method of Case technology. Method of information technology.	<b>LO 2</b>	<b>Written</b>
2	<b>Foreign language (professional)</b>	4	<b>Foreign language (professional)</b>  Its main goal is the development of speech skills: the ability to discuss, to express an opinion on various topics and in various situations. The study of grammar focuses on its use in oral speech. The program includes the acquisition and improvement of other language skills: listening, reading, writing, as well as speaking.  Studying on this course will allow students to gain knowledge of grammar and vocabulary of the English	General scientific methods: system analysis and synthesis, modeling, formalization, idealization.	<b>LO 1</b>	<b>Written</b>



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			language, increase the level of language proficiency, improve speaking, reading and translation skills, learn to perceive English speech by ear, overcome the language barrier. Elementary: understanding simple sentences, building separate phrases, understand written and spoken language hardly. Pre-intermediate: reading adapted texts, a small vocabulary. Intermediate: to have conversations on almost any topic, however, finding the right words, phrases and turns of speech, expressing opinions and understanding the interlocutor well, speaking quickly. Upper-intermediate: understanding ordinary English speech, regardless of the speed of speaking or the regional accent of the interlocutor. Advanced: knowledge phraseological units and idioms specific to the language, reading and understanding texts of any level of complexity. General English course offers learners the opportunity to become fluent in the language.			
3	<b>Psychology of management</b>	4	<b>Psychology of management-</b> Methodological foundations of management psychology. The development of psychological management theories. General theoretical questions of management psychology. Management analysis. Features personality manager. Psychological features of management tasks. The psychology of ownership. Professional activity manager. Functions of the subject of management. Psychology of managerial communication. Psychological characteristics of the staff. Psychology of employee motivation. Technology management of human resources of the organization. Psychological support personnel policy of the organization. Psychology of conflict in the organization. Technology warning professional deformation of the individual.	General scientific methods: system analysis and synthesis, modeling, formalization, idealization.	<b>LO 3</b>	<b>Written</b>
	<b>History and philosophy of science</b>	4	<b>History and philosophy</b> of science is obligatory for	General scientific methods: system	<b>LO 1</b>	<b>Written</b>



			all Master's degree programs and is an introduction to the general problems of philosophy of science. Science is considered in a broad socio-cultural context and in its historical development. Special attention is paid to the problems of the crisis of modern technogenic civilization and global trends in changing the scientific picture of the world, types of scientific rationality, value systems that scientists are guided by.	analysis and synthesis, modeling, formalization, idealization.		
<b>Cycle of Core Courses</b> <i>Optional Component</i>						
<b>APMCh-2</b>						
<b>Actual problems of modern chemistry</b>						
<b>Description of the module: in the process of mastering the module, an understanding and ability are formed in modern society, about the main problems of Chemistry at the modern stage of development and their elimination and assimilation. Undergraduates develop practical skills in the areas of basic chemistry.</b>						
4	Selected chapters in inorganic chemistry	5	The place of modern inorganic chemistry in the system of natural Sciences. The importance of inorganic chemistry for various fields of technology, medicine and agriculture. Periodic law, Periodic system of chemical elements: the 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. Inorganic chemistry of the future.	Demonstrative-illustrative method	LO 5 LO 6	<b>Written</b>
	Theoretical inorganic chemistry		Electronic structure of matter. Ionic bond. Types of ion gratings. Thermodynamic and kinetic regularities of behavior of compounds with ionic type of bonds. The nature of Covalence. Covalent compounds of nonmetals with multiple element-element bonds. Connection with the intermediate type of chemical bonding. Chemistry of aqueous and non-aqueous solutions. Theory of chemical bonds in transition metal compounds. Stability of covalent	Demonstrative-illustrative method	LO 6 LO 7	<b>Written</b>



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			compounds of transition metals. Ideas about the frame and cluster compounds. Compounds of early transition metals of groups III, IV and V.			
5	Applied Foundations of Modern Organic Chemistry	5	Current state of organic chemistry. Organic synthesis: the main stages, patterns and trends. Organic catalysis. Reactivity and catalysis, mechanisms of catalytic reactions. Computer synthesis of complex organic compounds, molecular design. Mathematical and computer modelling in organic chemistry. Chemistry of life processes. New in the chemistry of proteins and nucleic acids. Engineering Enzymology.	Demonstrative-illustrative method	LO 7 LO 8	<b>Written</b>
	Heterocyclic compounds		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 acid. Structure and structure of nucleic acids. DNA (deoxyribonucleic acids). RNA (ribonucleic acids).	Demonstrative-illustrative method	LO 1 LO 8	<b>Written</b>
6	Modern problems of analytical chemistry	5	Introduction. Metrological basis of chemical analysis. Types of chemical reactions and processes in analytical chemistry. Identification method. Methods of isolation, separation and concentration. Chromatographic methods of analysis. Gravimetric method of analysis. Titrimetric methods of analysis. Kinetic methods of analysis. Electrochemical methods of analysis: potentiometry, coulometry, voltammetry, etc. Spectroscopic methods of analysis.	Research method	LO 4 LO 5	<b>Written</b>
	Selected Chapters of Analytical Chemistry		Homogeneous equilibria in real solutions. Acid-base balance. The role of acid and solvent in determining the pH of aqueous solutions with a wide variation of the acid concentration. Comparative analysis of acid-base theories.	Research method	LO 6 LO 7	<b>Written</b>



			Influence of nature, dielectric permittivity of the solvent, charging capacity of the acid and the size of its molecules (ions) on the strength of acids. Equilibrium in precipitation reactions. Equilibrium in the processes of complex formation.			
<b>Cycle of Major courses</b> <i>University Component</i>						
<b>MDCh-3 The main directions of modern chemistry</b>						
<b>Module description: in the process of mastering the module, an understanding and ability to solve and master the main problems of modern chemistry is formed. Undergraduates master and develop knowledge of the main areas of chemistry, including physical chemistry, methods of Physico-Chemical Analysis, basic methodological approaches to the synthesis of organic-inorganic compounds and their research</b>						
7	Educational technologies and methodology of teaching general chemistry	6	Methodological bases of teaching inorganic chemistry. Modern methods and technology of teaching General and inorganic chemistry in universities. Methodical aspects of teaching the theme: "the Structure of the atom." Methodical bases of teaching the theme: "Chemical bond". Methods of teaching the main sections of inorganic chemistry: Solutions, theory of electrolytic dissociation, complex compounds. Methods of training of the topics: "Redox reactions. Electrode process".	Demonstrative-illustrative method	LO 1 LO 6	<b>Written</b>
<b>Cycle of Major courses</b> <i>Optional Component</i>						
8	Methods of solving problems in high level of chemistry	5	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	Case method, project	LO 4 LO 6	<b>Written</b>



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	Chemistry tasks for high school		<p>compounds. Methods of solving combined problems. Non-standard and Olympiad tasks.</p> <p>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.</p>	Demonstrative-illustrative method	LO 3 LO 6	<b>Written</b>
9	Modern methodological foundations of teaching physical and colloidal chemistry	5	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.	Case method, project	LO 6 LO 8	<b>Written</b>
	Methods of teaching physical and colloidal chemistry		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.	Case method, project	LO 4 LO 7	<b>Written</b>
10	Methods of using interactive methods of teaching chemistry at the University	6	Basic forms and methods of interactive learning. Interactive approach. Principles and methods of building an interactive type of educational process at the	Case method, project	LO 5 LO 6	<b>Written</b>





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			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.			
	General chemistry and teaching methods		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.	Demonstrative-illustrative method	LO5 LO 8	<b>Written</b>
11	Methodological aspects of teaching the course "Physical Research Methods"	<b>6</b>	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	Demonstrative-illustrative method	LO 5 LO 6	<b>Written</b>
	Kinetics of electronic processes		Polarization and overvoltage. Double electric layer. Electro capillary 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.	Demonstrative-illustrative method	LO 4 LO 7	<b>Written</b>



**BSR-4** Fundamentals of scientific research

Module description:

This module teaches disciplines aimed at the formation of scientific skills on the synthesis and identification of organic compounds, the organization, creation of general scientific research work, selection and mastery of the necessary analysis methods, familiarization with the principles of research, determination of the effectiveness of scientific research methods.

12	Methodology and technology of scientific research	7	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.	Demonstrative-illustrative method	LO 1 LO 6	<b>Written</b>
	Nanomaterials and nanotechnology	5	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.	Demonstrative-illustrative method	LO 3 LO 6	<b>Written</b>
	Nanochemistry	5	Objects of Nano chemistry research. Stages of development and application of Nano chemistry. Classification of objects of Nano chemistry. The	Demonstrative-illustrative method	LO 4 LO 5	<b>Written</b>



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			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.			
13	Internship practice	<b>10</b>	Development of scientific and methodological knowledge and compliance with the requirements of the international labor market, creative potential in research pedagogical practice; consideration of the main directions and development of highways in the modern education system; - study of the personality of highways.	Practical work	-	<b>report</b>
14	RW 5(6).03 Research work of a master's student, including passing an internship and completing a master's thesis.	<b>2</b>	Research work is Carried out aimed at developing the ability of undergraduates to make independent theoretical and practical conclusions. Develops skills of objective assessment of scientific information, the ability to integrate interdisciplinary knowledge into free scientific research. Considers ways of applying scientific knowledge in educational activities, discusses them in the scientific environment.	Practical work	-	<b>report</b>
15	Research work of a master's student, including passing an internship and completing a master's thesis.	<b>1</b>	Research work is Carried out aimed at developing the ability of undergraduates to make independent theoretical and practical conclusions. Develops skills of objective assessment of scientific information, the ability to integrate interdisciplinary knowledge into free scientific research. Considers ways of applying scientific knowledge in educational activities, discusses them in the scientific environment.	Practical work	-	<b>report</b>
16	Research work of a master's student, including passing an internship and	<b>15</b>	Research work is Carried out aimed at developing the ability of undergraduates to make independent theoretical and practical conclusions. Develops skills of objective assessment of scientific information, the ability to	Practical work	-	<b>report</b>



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	completing a master's thesis.		integrate interdisciplinary knowledge into free scientific research. Considers ways of applying scientific knowledge in educational activities, discusses them in the scientific environment.			
17	Registration and defense of the Master's thesis (RDMT)	<b>8</b>	Preparation and defense of Master's thesis, defense	Completion of the thesis, registration	-	<b>Defense</b>

**MRW – 5 Master's student research work**

Module description: The research work is considered an important component of the master's degree in chemistry education and includes various stages and activities that contribute to the academic and professional growth of the master's students. Through teaching practice, research practice, internships, and completion of a master's thesis, graduate students gain valuable experience in teaching, research, and practical application of their knowledge. Applying research methods and searching academic publications will further strengthen their research skills and strengthen their participation in the academic community. Overall, this experience lays the foundation for a successful career for graduate students.

<b>№</b>	<b>Name of subject and code</b>	<b>Cycle/component</b>	<b>Credits</b>	<b>Subject description</b>	<b>Teaching methods</b>	<b>LO by EP</b>	<b>Assessment methods</b>
<b>1</b>	Pedagogical practice	CC UC	4	Development of creative potential, development of scientific and methodological knowledge in pedagogical practice and adaptation to the requirements of the international labor market; to consider the main directions and development of doctoral students in the modern education system;	Educational process	-	Report
<b>2</b>	Research practice	CC UC	3	Development of creative potential, development of scientific and methodological knowledge in pedagogical practice and adaptation to the			



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				requirements of the international labor market; to consider the main directions and development of doctoral students in the modern education system;			
3	Research practice	CC UC	7	Development of creative potential, development of scientific and methodological knowledge in pedagogical practice and adaptation to the requirements of the international labor market; to consider the main directions and development of doctoral students in the modern education system;			
4	Undergraduate research work, including internships and the implementation of a Master's thesis (MRW)	MRW	1	Research work is Carried out aimed at developing the ability of undergraduates to make independent theoretical and practical conclusions. Develops skills of objective assessment of scientific information, the ability to integrate interdisciplinary knowledge into free scientific research. Considers ways of applying scientific knowledge in educational activities, discusses them in the scientific environment.	Practical work	-	
	2		Research work is carried out aimed at developing the ability of doctoral students to make their own theoretical and practical conclusions. The formation of one's own opinion forms the skill of an objective assessment of scientific information, the ability to integrate interdisciplinary knowledge into a free scientific search. Examines the ways of applying scientific				
	Methods of scientific research		1				



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					knowledge in educational activities, discusses them in the scientific community.			
5	Undergraduate research work, including internships and the implementation of a Master's thesis (MRW)	MRW	2	4	Research work is Carried out aimed at developing the ability of undergraduates to make independent theoretical and practical conclusions. Develops skills of objective assessment of scientific information, the ability to integrate interdisciplinary knowledge into free scientific research. Considers ways of applying scientific knowledge in educational activities, discusses them in the scientific environment.	Practical work	-	
	Academic writing				2			



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					research practice are considered. In the process of conducting research work, skills are formed to use research methods related to the subject area of research and methods for assessing the accuracy of the results of research work and its effectiveness..			
6	Undergraduate research work, including internships and the implementation of a Master's thesis (MRW)	MRW	3	7	Research work is Carried out aimed at developing the ability of undergraduates to make independent theoretical and practical conclusions. Develops skills of objective assessment of scientific information, the ability to integrate interdisciplinary knowledge into free scientific research. Considers ways of applying scientific knowledge in educational activities, discusses them in the scientific environment.	Practical work	-	
	Methods of scientific research		4		Research work is carried out aimed at developing the ability of doctoral students to make their own theoretical and practical conclusions. The formation of one's own opinion forms the skill of an objective assessment of scientific information, the ability to integrate interdisciplinary knowledge into a free scientific search. Examines the ways of applying scientific knowledge in educational activities, discusses them in the scientific community.			
7	Undergraduate research work, including	MRW	11		Research work is Carried out aimed at developing the ability of undergraduates to make independent theoretical and practical	Practical work	-	



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	internships and the implementation of a Master's thesis (MRW)			conclusions. Develops skills of objective assessment of scientific information, the ability to integrate interdisciplinary knowledge into free scientific research. Considers ways of applying scientific knowledge in educational activities, discusses them in the scientific environment.			
<b>8</b>	<b>Final Certification</b>	8	FC	Registration and defense of the Master's thesis (RDMT)			





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