

SYLLABUS
Fall semester 2024-2025 academic year
Educational program "6B07102 Chemical Engineering"

ID and name of course	Independent work of the student (IWS)	Number of credits			General number of credits	Independent work of the student under the guidance of a teacher (IWST)	
		Lectures (L)	Practical classes (PC)	Lab. classes (LC)			
General and inorganic chemistry[80079]	4	1,5	1,5	3	6	4	
ACADEMIC INFORMATION ABOUT THE COURSE							
Learning Format	Cycle, component	Lecture types	Types of practical classes		Form and platform final control		
Offline	MD. University component.	Discussion, analytical	seminars		Written exam, system Univer		
Lecturer - (s)	Askar BAKHADUR						
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ACADEMIC COURSE PRESENTATION							
Purpose of the course	Expected Learning Outcomes (LO) * As a result of studying the course the student will be able to:				Indicators of LO achievement (ID)		
The purpose of discipline: to form the ability to analyze the properties of elements and their compounds, as well as to establish a link between the structure and properties of simple and complex compounds. During the study of the discipline students will learn following aspects: the main classes of inorganic compounds, patterns of chemical reactions, electrolyte and non-electrolyte solutions, redox processes, chemistry of metals and nonmetals, complex compounds, using the research method of training.	1. able to predict the basic concepts and laws of chemistry: properties of chemical elements and their compounds based on the periodic law and the structure of the atom from the point of view of the structure of atoms and molecules;				1.1 Defines basic stoichiometric laws, chemical and gas laws and can use them to determine molar mass, molar equivalent mass, amount and mass of substances, relative density and other parameters;		
					1.2 Write the electronic configuration and energy diagram of orbital atoms of elements according to the formula.		
	2. Can demonstrate knowledge of the structure of atoms and molecules, the theory of chemical bonds;				2.1 Formulates the rules that determine the order of filling atomic orbitals with electrons. Analyzes the periodic nature of changes in some properties of atoms, elements and simple substances.		
					2.2 The difference between modern models and fundamental approaches to chemical bonding.		
	3. Describes the laws and thermodynamic parameters of chemical reactions and is able to determine their relationship;				3.1 Creates an enthalpy diagram and can calculate the enthalpy of the process		
					3.2 Evaluates the direction and depth of this process according to thermodynamic parameters.		
	4. Determines the chemical properties of inorganic substances, highlighting the main types of chemical reactions (oxidation-reduction, complex formation, hydrolysis, catalytic reactions);				4.1 Compose reaction equations using the ion-electron balance method.		
					4.2 Describe the laws of chemical reactions, the dependence of these laws on external conditions, and the mechanism of chemical reconstruction.		

	1. Birgit Weber, Coordination Chemistry: Basics and Current Trends, Springer Nature, 2023 2. Harish Kumar Pandey, Basic Coordination Chemistry, Pacific Books International, 2016 3. Geoffrey A. Lawrance, Introduction to Coordination Chemistry, Wiley, 2009 4. Кукушкин Ю. Н. Химия координационных соединений: Учеб. пособие для студентов хим. и хим.-технол. спец. вузов. – М.: Высш. шк., 1985. – 455 с., ил. 5. Joan Ribas Gispert, Coordination Chemistry, Wiley-VCH, 2008 Additional: 1. Костромина Н. А., Кумок В. Н., Скорик Н. А. Химия координационных соединений: Учеб. пособие для студентов хим. фак. ун-тов и хим.-технол. спец. вузов/Под ред. Н. А. Косроминой. – М.: Высш. шк., 1990. – 432 с., ил. 2. Huheey J. E., Keiter E. A., Keiter R. L. Inorganic Chemistry: Principles of Structure and Reactivity. 4th ed. New York NY: Harper Collins College; 1993. 3. Луцкий Д. Л., Николаев А. А., Луцкая А. М. Координационные соединения: Учебное пособие для студентов. – М.: «Академия естествознания», 2005. – 76 с. Research infrastructure 1. Center for Physico-Chemical Research and Analysis Methods 2. Institute of Combustion Problems Professional scientific databases 1. Web of Science – https://www.webofscience.com/wos/wosce/basic-search 2. Bielefeld Academic Search Engine – https://www.base-search.net/ 3. PubChem – https://pubchem.ncbi.nlm.nih.gov/ 4. Cambridge Structural Database – https://www.ccdc.cam.ac.uk/structures 5. ChemSpider – http://www.chemspider.com/ Internet resources 1. https://www.mooc-list.com/tags/quantum-chemistry 2. http://elibrary.kaznu.kz/ru
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Academic course policy	The academic policy of the course is determined by <u>the Academic Policy and the Policy of Academic Integrity of Al-Farabi Kazakh National University</u>. Documents are available on the main page of IS Univer Integration of science and education. The research work of students, undergraduates and doctoral students is a deepening of the educational process. It is organized directly at the departments, laboratories, scientific and design departments of the university, in student scientific and technical associations. Independent work of students at all levels of education is aimed at developing research skills and competencies based on obtaining new knowledge using modern research and information technologies. A research university teacher integrates the results of scientific activities into the topics of lectures and seminars (practical) classes, laboratory classes and into the tasks of the IWS, IWS, which are reflected in the syllabus and are responsible for the relevance of the topics of training sessions and assignments. Attendance. The deadline for each task is indicated in the calendar (schedule) for the implementation of the content of the course. Failure to meet deadlines results in loss of points. Academic honesty. Practical/laboratory classes, IWS develop the student's independence, critical thinking, and creativity. Plagiarism, forgery, the use of cheat sheets, cheating at all stages of completing tasks are unacceptable. Compliance with academic honesty during the period of theoretical training and at exams, in addition to the main policies, is regulated by the "Rules for the final control", "Instructions for the final control of the autumn / spring semester of the current academic year", "Regulations on checking students' text documents for borrowings". Documents are available on the main page of IS Univer. Basic principles of inclusive education. The educational environment of the university is conceived as a safe place where there is always support and equal attitude from the teacher to all students and students to each other, regardless of gender, race / ethnicity, religious beliefs, socio-economic status, physical health of the student, etc. All people need the support and friendship of peers and fellow students. For all students, progress is more about what they can do than what they can't. Diversity enhances all aspects of life. All students, especially those with disabilities, can receive counseling assistance by phone / e- mail askar.bakhadur@gmail.com or via video link in MS Teams https://teams.live.com/joincommunity/FEAB8ESin_OnqeWvgI
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INFORMATION ABOUT TEACHING, LEARNING AND ASSESSMENT

Score-rating letter system of assessment of accounting for educational achievements				Assessment Methods
Grade	Digital equivalent points	points, % content	Assessment according to the traditional system	Criteria-based assessment is the process of correlating actual learning outcomes with expected learning outcomes based on clearly defined criteria. Based on formative and summative assessment.
A	4.0	95-100	Great	Formative assessment is a type of assessment that is carried out in the course of daily learning activities. It is the current measure of progress. Provides an

A-	3.67	90-94	Fine	operational relationship between the student and the teacher. It allows you to determine the capabilities of the student, identify difficulties, help achieve the best results, timely correct the educational process for the teacher. The performance of tasks, the activity of work in the classroom during lectures, seminars, practical exercises (discussions, quizzes, debates, round tables, laboratory work, etc.) are evaluated. Acquired knowledge and competencies are assessed. Summative assessment - type of assessment, which is carried out upon completion of the study of the section in accordance with the program of the course. Conducted 3-4 times per semester when performing IWS. This is the assessment of mastering the expected learning outcomes in relation to the descriptors. Allows you to determine and fix the level of mastering the course for a certain period. Learning outcomes are evaluated.	
B+	3.33	85-89			
B	3.0	80-84			
B-	2.67	75-79			
C+	2.33	70-74	Satisfactorily	Formative and summative assessment	Points % content
C	2.0	65-69		Activity at lectures	0
C-	1.67	60-64		Work in seminars	30
D+	1.33	55-59		Independent work	18
D	1.0	50-54	Unsatisfactory	Midterms controls	12
FX	0.5	25-49		Final control (exam)	40
F	0	0-24		TOTAL	100

Calendar (schedule) for the implementation of the content of the course. Methods of teaching and learning.

A week	Topic name	Number of hours	Max. ball
MODULE 1 Introduction to the coordination chemistry			
1	L 1. Introduction to the chemistry of coordination compounds.	1	
	Seminar 1. Coordination theory of A. Werner. Nomenclature of coordination compounds	2	8
2	L 2. Types of coordination compounds.	1	
	Seminar 2. Multinuclear coordination compounds.	2	8
3	L 3. Isomerism of coordination compounds.	1	
	Seminar 3. Optical isomers of coordinated compounds. IWS 1. Consultation on IWS 1.	2	9
4	L 4. Coordination compounds with unusual coordination numbers.	1	
	Seminar 4. Compounds with coordination numbers of 7, 8, 9, 10, and above.	2	8
MODULE 2 Physico-chemical characterization of coordination compounds			
5	L 5. Chemical bonds in coordination compounds.	1	
	Seminar 5. Describe the chemical bond in coordination compounds.	2	9
	IWS 1. Coordination compounds in nature and industry.		30
6	L 6. Ligands of coordination compounds.	1	
	Seminar 6. Classifications of ligands in coordination compounds.	2	8
7	L 7. The mutual influence of ligands in the internal sphere of coordination compounds.	1	
	Seminar 7. Comparisons of ligands in coordination compounds. Control work 1.	2	20
Midterm control 1			100
8	L 8. Reaction mechanisms in coordination compounds.	1	
	Seminar 8. Heterogeneous reactions.	2	7
	IWS 2. Consultation on IWS 2.		
9	L 9. Acid-base properties of coordination compounds.	1	
	Seminar 9. Acid-base properties of coordination compounds.	2	7
10	L 10. Equilibria in solutions of coordination compounds.	1	
	Seminar 10. Equilibria in solutions of coordination compounds.	2	7
11	L 11. The redox properties of coordination compounds.	1	
	Seminar 11. The redox properties of coordination compounds.	2	8
	IWS 2. Physico-chemical methods of research for coordination compounds.		30
12	L12. Reactivity of coordinated ligands.	1	
	Seminar 12. Elimination of the characteristic properties of ligands because of coordination and the use of this phenomenon to mask individual functional groups.	2	7
	IWS 3. Colloquium.		
MODULE 3 Application of coordination compounds			
13	L 13. The role of the solvents in coordination chemistry.	1	
	Seminar 13. Influence of the solvents on the reaction rate and its mechanism.	2	7

14	L 14. Types of solid-state thermal transformations of coordination compounds.	1	
	Seminar 14. Application of coordination compounds.	2	7
15	L 15. Synthesis of coordination compounds.	1	
	Seminar 15. Application of coordination compounds in drugs and cosmetics. Control work 2.	2	20
	IWST 4. Consultation before exam.		
Midterm control 2			100
Final control (exam)			100
TOTAL for course			100

RUBRICATOR OF THE SUMMATIVE ASSESSMENT

CRITERIA EVALUATION OF LEARNING OUTCOMES

Task name "Coordination compounds in nature and industry", (30% of 100%)

Criterion	"Excellent" Max. weight in 23-30%	"Good" Max. weight in 15-23%	"Satisfactory" Max. weight in 8-15%	"Unsatisfactory" Max. weight in 0-8%
Understanding theories and the concepts presented in this discipline.	Deep understanding of the theories and concepts presented in this discipline. Freely operates with information from the educational material.	Understanding of the theories and concepts presented in this course. Sufficient mastery of the information from the course material.	Limited understanding and acquisition of the theories and concepts presented in this course. Satisfactory acquisition of information from the course material.	Superficial understanding/lack of understanding of the theories and concepts presented in the course. Poor mastery of information from the course material.
Possession of skills in carrying out practical work based on specific tasks.	Connects theoretical and practical knowledge well. Skillfully applies theory in processing empirical data.	Understands how to link theoretical and practical knowledge. Applies theory to the processing of empirical data	Limited understanding of the relationship between theory and practice. Satisfactorily applies theory to the processing of empirical data	Little or no understanding of the relationship between theory and practice. Cannot apply theory to the processing of empirical data.
Full operation of the information obtained from this course and their further development	Excellent at using the information received to solve assigned tasks. Ability to combine data from different sources to achieve a goal.	Operates with the information received to a sufficient extent to solve the assigned tasks. Can use knowledge from other disciplines.	Satisfactorily operates with the information received to solve the tasks set. Limited use of knowledge from other disciplines.	Cannot operate with the received information to solve the assigned tasks. Lack of ability to combine knowledge from different fields of science.
Ability to present completed work	The presentation has a clear structure and logic. Skillfully operates with data and presents complex topics in an easy-to-understand format.	Sufficiently structured presentation. Able to present work clearly and with restraint.	The presentation lacks logic and consistency. There are some key errors, and the clarity needs to be improved.	The presentation is unclear, difficult to follow the content. Many errors due to poor understanding of the material.

Task name "Physico-chemical methods of research for coordination compounds", (30% of 100%)

Criterion	"Excellent" Max. weight in 23-30%	"Good" Max. weight in 15-23%	"Satisfactory" Max. weight in 8-15%	"Unsatisfactory" Max. weight in 0-8%
Understanding theories and the concepts presented in this discipline.	Deep understanding of the theories and concepts presented in this discipline. Freely operates with information from the educational material.	Understanding of the theories and concepts presented in this course. Sufficient mastery of the information from the course material.	Limited understanding and acquisition of the theories and concepts presented in this course. Satisfactory acquisition of information from the course material.	Superficial understanding/lack of understanding of the theories and concepts presented in the course. Poor mastery of information from the course material.

Possession of skills in carrying out practical work based on specific tasks.	Connects theoretical and practical knowledge well. Skillfully applies theory in processing empirical data.	Understands how to link theoretical and practical knowledge. Applies theory to the processing of empirical data	Limited understanding of the relationship between theory and practice. Satisfactorily applies theory to the processing of empirical data	Little or no understanding of the relationship between theory and practice. Cannot apply theory to the processing of empirical data.
Full operation of the information obtained from this course and their further development	Excellent at using the information received to solve assigned tasks. Ability to combine data from different sources to achieve a goal.	Operates with the information received to a sufficient extent to solve the assigned tasks. Can use knowledge from other disciplines.	Satisfactorily operates with the information received to solve the tasks set. Limited use of knowledge from other disciplines.	Cannot operate with the received information to solve the assigned tasks. Lack of ability to combine knowledge from different fields of science.
Ability to present completed work	The presentation has a clear structure and logic. Skillfully operates with data and presents complex topics in an easy-to-understand format.	Sufficiently structured presentation. Able to present work clearly and with restraint.	The presentation lacks logic and consistency. There are some key errors, and the clarity needs to be improved.	The presentation is unclear, difficult to follow the content. Many errors due to poor understanding of the material.

Dean _____

Galeyeva A.K.

Chair of the Academic Committee
on the Quality of Teaching and Learning _____

Bektemissova A.U.

Head of Department _____

Niyazbayeva A.I.

Lecturer _____

Bakhadur A.M.