SYLLABUS
Fall semester 2024-2025 academic year.
Educational program "6B05301 - Chemistry"

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)		
91714 Chemistry of coordination compounds	2	15 h	30 h	0	5	4 h

ACADEMIC INFORMATION ABOUT THE COURSE

Learning Format	Cycle, component	Lecture types	Types of practical classes	Form and platform final control
Offline, full-time	MD. University component.	Problematic, review and analytical	Round table discussions, presentations	Written exam, system Univer
Lecturer 1	Askar BAKHADUR			
e-mail:	askar.bakhadur@gmail.com			
Phone:	+77783142980			

ACADEMIC COURSE PRESENTATION

Purpose of the course	Expected Learning Outcomes (LO) * As a results of studying the course the student will be able to:	Indicators of LO achievement (ID)
The purpose of the discipline: to form the ability to apply theoretical knowledge about chemical bonds, stereochemistry, stability, reactivity of coordination compounds for the synthesis of coordination compounds and their derivatives. Nomenclature and classification; isomerism; A.Werner coordination theory; ionic-covalent representations; the structure of complex compounds from the standpoint of the valence bonds method; crystal field theory will be considered.	1. Classify the coordination compounds and explain the terms used in coordination chemistry.	1.1 know the classification, and nomenclature of the coordination compounds.
		1.2 use the terms in coordination chemistry correctly.
	2. Identify the chemical bond, predict the reaction mechanisms and reactivity of coordination compounds.	2.1 understand the chemical structure of coordination compounds.
		2.2 can explain valence bond and crystal field theories.
	3. Describe chemical interactions and their mechanisms in coordination compounds.	3.1 can define the properties of the coordination compounds.
		3.2 can show the ways to obtain coordination compounds.
	4. Select physico-chemical methods of analysis in the research of coordination compounds.	4.1 can choose methods to characterize coordination compounds.
		4.2 can give definitions to the physicochemical methods of analysis.
	5. Examine scientific literature and articles to investigate the properties and applications of coordination compounds.	5.1 know how to access scientific literature and how to choose the right source.
		5.2 use different sources to study coordination compounds and to research their application, properties, characteristics.
Prerequisites	[89515] Mathematics, [6840] General Chemistry, [92080] Inorganic Chemistry, [91792] Physical Chemistry, [39121] Chemistry of Solid Body	
Postrequisites	[91824] Organic Chemistry, [4642] Physical Methods of Research, [92111] Basis of Chemical Technology	
Learning Resources	Literature: Main:	

	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. Костромина. – 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/woscc/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

Academic course policy	The academic policy of the course is determined by the Academic Policy and the Policy of Academic Integrity of Al-Farabi Kazakh National University . 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 IWST, 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/l/community/FEAB8ESin_QnqeWygI*

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. **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	4.0 _	95-100	Great	

A-	3.67	90-94		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	Fine	
B	3.0	80-84		**Formative and summative assessment** — **Points % content**
B-	2.67	75-79		Activity at lectures — 0
C+	2.33	70-74		Work in seminars — 30
C	2.0	65-69	Satisfactorily	Independent work — 18
C-	1.67	60-64		Midterms controls — 12
D+	1.33	55-59		Final control (exam) — 40
D	1.0	50-54		TOTAL — 100
FX	0.5	25-49	Unsatisfactory	
F	0	0-24		

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.	2	9
	IWST 1. Consultation on IWS 1.		
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
	IWST 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
	IWST 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.**