University of Gdańsk

Subject card

Subject name and code	Unlocking the Secrets of Life: Spectroscopy in Bioinorganic Chemistry, PG_00171097		
Field of study	Chemical Business, Chemistry, Environmental Protection		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2027/2028
Education level	Master's studies	Subject group	Optional subject group
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	English
Semester of study	3	ECTS credits	4.0
Learning profile	academic	Assessment form	credit
Conducting unit	Laboratory of Intermolecular Interactions -> Department of Bioinorganic Chemistry -> Faculty of Chemistry -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Agnieszka Chylewska	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	0.0	0.0	30.0	0.0	0.0	30

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	30	10.0	60.0	100

Subject objectives

The aim of the course is:

- to familiarize students with fundamental methods of chemical and physicochemical analysis used in spectroscopic studies of bioinorganic chemical systems.

- to give the students an idea of the importance and significance of chemistry in our lives and body;

- to develop specific interests, habits, and abilities encompassing all sciences;

- to help the student discover whether he/she has an aptitude for further work in pure or applied sciences and to induce such people to continue science studies

Students will learn laboratory procedures, including safety rules, calibration techniques, acid-base equilibrium analysis, and methods for determining stoichiometry and kinetic parameters involving coordination compounds. They will also gain skills in applying potentiometry to determine the composition of coordination compounds based on the presence of chloride ions in the studied substance's formula.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[CHEMMU2_U01] Plans and implements chemical experiments of medium complexity.	The student is able to plan and conduct chemical experiments of increased complexity, selecting appropriate analytical methods and research techniques, and interpreting the obtained results in the context of chemical theories.	[SU3] text preparation/written work
[CHEMMU2_U03] Finds necessary information in specialist literature, databases and other sources, lists basic scientific journals in chemistry.	The student is able to search for necessary information in professional literature, databases, and other sources, and is familiar with and can list the key scientific journals in the field of chemistry, using them to deepen their knowledge and complete scientific tasks.	[SU3] text preparation/written work
[CHEMMU2_K01] Knows the limitations of her/his own knowledge; understands the need for further education and can inspire other people to do so.	The student recognizes the limitations of their knowledge, demonstrates a willingness to deepen it, and independently acquires new skills. They understand the importance of lifelong learning and can inspire others to develop their competencies in chemical analysis.	[SK4] test/exam - oral or written
[CHEMMU2_U05] Presents the results of research in the form of an independently written paper containing a description and justification of the purpose of the work, adopted methodology, results and their significance in comparison to other similar research.	The student presents research results in the form of an independently written paper, which includes a clear description and justification of the research aim, the adopted methodology, results, and their interpretation in the context of existing studies, demonstrating the ability to critically analyze literature and formulate conclusions.	[SU4] test/exam - oral or written
[CHEMMU2_W09] Classifies specialist IT tools used in statistical evaluation of experiment results.	The student is able to classify specialized software tools used in the statistical analysis of experimental results, understands their functions, and selects the appropriate software for analyzing experimental data based on the nature of the study.	[SW3] text preparation/written work
[CHEMMU2_K06] Undertakes research tasks consciously and responsibly, understanding the social aspects of the practical application of the acquired knowledge and skills and the responsibility related to it.	The student consciously and responsibly undertakes research tasks, considering the social aspects of the practical application of acquired knowledge and skills, and understands the associated responsibility for the impact of their actions on society and the environment.	[SK3] text preparation/written work
[CHEMMU2_W03] Demonstrates extended knowledge in the field of modern measuring techniques used in chemical analysis.	The student demonstrates an in-depth knowledge of modern measurement techniques used in chemical analysis, understands their principles, applications, and limitations, and is able to critically evaluate the results obtained using these techniques.	[SW3] text preparation/written work
[CHEMMU2_W01] Uses knowledge of spectroscopic methods of chemical compound analysis.	The student applies in-depth knowledge of spectroscopic methods for the analysis of chemical compounds, understands their principles, applications, and limitations, and can use appropriate spectroscopic techniques to analyze various types of chemical compounds.	[SW3] text preparation/written work

<table>
<tr><td>Subject contents</td><td>Introduction, materials and safety rules in the laboratory, spectroscopic methodology, procedures and duties explanation.

Calibration curves role in research the case of studies.

Acid-base equilibria of (bio)inorganic and organic ligands (determination of pKa values).

Jobs plots to establish stoichiometry of metal complexes with bioligands.

Kinetic parameters and activation energy determination of processes involving coordination compounds.

Potentiometric determination of coordination compound formula based on the presence of chloride ions.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>30% Post-Lab reports</td><td>30.0%</td><td>30.0%</td></tr>
<tr><td>10% Lab Technique</td><td>10.0%</td><td>10.0%</td></tr>
<tr><td>60% Pre-Lab test</td><td>60.0%</td><td>60.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>1. I. Bertini, D. Garner, S.J. Lippard. J. Reedijk, A.X. Trautwein, M.J. Clarke, E. Kimura, K.N. Raymond, P.J. Sadler, R. Weiss, Topics in Biological Inorganic Chemistry Volume 1, Springer, 1-200, 1999.
2. R. S. Mikkelsen, E. Corton, Bioanalytical Chemistry Wiley-Interscience, 1-375, 2004.
3. G. A. Lawrance, Introduction to Coordination Chemistry, University of Newcastle, Callaghan, NSW, Australia A John Wiley, 1-307, 2010.
4. G.E. Rodgers, Descriptive Inorganic, Coordination, and Solid-State Chemistry, Third Edition Belmont, Brooks Cole, USA, 1-668, 2012.</td></tr>
<tr><td>Supplementary literature</td><td>K. Nakamoto, Infrared and Raman Spectra of Inorganic and Coordination Compounds: Part A: Theory and Applications in Inorganic Chemistry Part A and B (DOI:10.1002/9780470405840); 2008.</td></tr>
<tr><td>eResources addresses</td><td>Supplementary
https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Supplemental_Modules_and_Websites_(Inorganic_Chemistry)/Coordination_Chemistry/Structure_and_Nomenclature_of_Coordination_Compounds/Introduction_to_Coordination_Chemistry - Introduction to Coordination Chemistry
https://onlinelibrary.wiley.com/doi/book/10.1002/9780470405840 - K. Nakamoto, Infrared and Raman Spectra of Inorganic and Coordination Compounds: Part A: Theory and Applications in Inorganic Chemistry Part A</td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>Werner complexes; the significance of coordination compounds with transition metal ions; spectroscopic methods (UV-Vis, ATR) in studies involving coordination compounds (determining formulas; interactions with biomolecules); chemistry of d-block metal complexes; stability of coordination bonds; the role of metal complexes in medicine.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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