GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	COORDINATION AND BIOINORGANIC CHEMISTRY, PG_00064386		
Field of study	Chemistry		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2025/2026
Education level	first-cycle studies	Subject group	Optional subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	3	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Inorganic Chemistry -> Faculty of Chemistry -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Anna Dołęga	
	Teachers	prof. dr hab. inż. Anna Dołęga dr hab. inż. Łukasz Ponikiewski dr inż. Anna Ordyszewska-Lach	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	15.0	0.0	15.0	45

E-learning hours included: 0.0

eNauczanie source addresses:

Moodle ID: 1572 CHEMIA KOORDYNACYJNA I BIONIEORGANICZNA
https://enauczanie.pg.edu.pl/2025/course/view.php?id=1572

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	45	5.0	25.0	75

Subject objectives

The aim of the course Coordination and Bioinorganic Chemistry is to introduce students to the fundamentals of the structure, properties, and reactivity of coordination compounds as well as their roles in biological systems. Students will become familiar with theories of bonding and stability of complexes, mechanisms of metalligand interactions, and selected applications of coordination compounds in catalysis, medicine, and technology. Special emphasis is placed on the role of metals in biological systems, such as enzymes, transport proteins, and redox processes, as well as on practical aspects of synthesis and characterization of coordination complexes.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U03] operates typical laboratory apparatus and carries out analyses to identify chemical compounds and materials, integrating computational methods and application software	The student operates standard laboratory equipment and performs analyses for the identification of coordination and bioinorganic compounds as well as materials, integrating computational methods and specialized application software.	[SU4] Assessment of ability to use methods and tools
[K6_W06] identifies trends in research and scientific apparatus in the fields of science and scientific disciplines relevant to chemistry and chemical engineering	The student identifies trends in the development of research and scientific instrumentation in the field of coordination and bioinorganic chemistry, as well as in related areas of chemistry and chemical engineering.	[SW2] Assessment of knowledge contained in presentation
[K6_U09] is able to recognise hazards, counteract them and work with chemical reagents and basic technical apparatus in accordance with health and safety principles and the concept of sustainability	The student is able to identify potential risks, take preventive measures, and work safely with chemical reagents and basic laboratory equipment, in accordance with health and safety standards and the principles of sustainable development.	[SU1] Assessment of task fulfilment
[K6_W02] classifies acquired information, assessing its usefulness in solving the posed problems concerning the synthesis and analysis of selected groups of compounds, determining their physical and chemical properties, making measurements and determining the parameters of chemical reactions and processes	The student classifies acquired information and evaluates its relevance for solving problems related to the synthesis and analysis of coordination and bioinorganic compounds, the determination of their physical and chemical properties, as well as performing measurements and determining the parameters of chemical reactions and processes.	[SW1] Assessment of factual knowledge

Subject contents

The course covers the **fundamentals of coordination chemistry**, including theories of the structure of coordination compounds and the concept of isomerism. It addresses aspects of **thermodynamics and kinetics**, particularly equilibria in solutions of coordination compounds, as well as the stability and lability of complexes. The program also includes a detailed study of the **structure and types of coordination compounds**, emphasizing the role of the central atom and ligands.

The course explores **bonding theories**, magnetic properties, and electronic spectroscopy of coordination compounds. It provides an introduction to the **chemistry of compounds containing metalcarbon bonds**, including their synthesis, structure, and applications in organometallic chemistry.

A significant part of the course is devoted to **bioinorganic chemistry**, introducing key concepts and the classification of bioelements. Topics include bioinorganic chemistry of s-block elements and d-block elements, including the role of manganese in photosynthesis (photosystem II), the role of iron in oxygen transport (hemoglobin), nitrogen fixation (nitrogenase), and electron transfer processes. The course also covers zinc enzymes involved in proton and hydride transfer, hydrolysis reactions, and zinc finger structures, as well as the role of other metals and metalloproteins involved in metal storage.

Further topics include **metal compounds as pharmaceuticals**, with examples such as cisplatin, gold compounds, silver compounds, and others. The course concludes with an overview of **synthetic bioinorganic chemistry**, illustrating selected applications.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
kolokwium	50.0%	40.0%
testy, sprawozdania	50.0%	30.0%
prezentacja	50.0%	30.0%

Recommended reading

Basic literature	M. Cieślak-Golonka, J. Starosta, A. Trzeciak, Chemia koordynacyjna metali w zastosowaniach, PWN, 2017 J. Oszczudłowski, T. Starodub, W. Starodub, Chemia związków koordynacyjnych, PWN, 2017
Supplementary literature	none

	eResources addresses	
Example issues/ example questions/ tasks being completed	1) The oxygen produced in the process of photosynthesis is a product of the oxidation of: a) glutamate b) water c) glucose d) aspartate 2) The only organometallic compound in the human body, vitamin B, contains: a) cobalt ions b) manganese ions c) iron ions d) nickel ions 3) Ferritin is: a) a protein that transfers electrons b) a protein that transfers oxygen c) a low-molecular-weight chemical compound secreted by bacteria to bind iron ions d) a large protein that stores up to several thousand iron ions 4) In deoxyhemoglobin: a) iron is in the +2 oxidation state b) iron is in the +3 oxidation state c) iron is in the +4 oxidation state d) oxygen is bound to iron ions	
Work placement	Not applicable	

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