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 2026		Academic year of realisation of subject	2027/2028			
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 -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. inż. Anna Dołęga				
	Teachers						
Lesson types	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						
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 is to introduce students to the fundamentals of coordination, organometallic, and bioinorganic chemistry and to develop their ability to interpret the structure, properties, and reactivity of metal compounds based on modern theories of chemical bonding, thermodynamics, kinetics, and spectroscopic methods. The course also aims to present the role of metal ions in biological systems and to develop the ability to relate the structure and properties of coordination compounds to their biological functions and applications, particularly in chemistry, biology, and medicine.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[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	Is able to identify hazards associated with laboratory work and safely handle chemical reagents and basic laboratory equipment used in the synthesis and investigation of coordination compounds, in accordance with occupational health and safety regulations and the principles of sustainable development.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task
[K6_W06] identifies trends in research and scientific apparatus in the fields of science and scientific disciplines relevant to chemistry and chemical engineering	Knows selected current research directions in coordination, organometallic, and bioinorganic chemistry and understands the importance of advances in research and instrumental methods for the characterization and application of metal compounds.	[SW1] Assessment of factual knowledge
[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	Has the necessary knowledge to analyze, classify, and critically evaluate information in terms of its usefulness for solving problems related to the synthesis and analysis of coordination and organometallic compounds, determining their physical and chemical properties, and interpreting measurement results and parameters of the chemical reactions and processes studied.	[SW3] Assessment of knowledge contained in written work and projects
[K6_U03] operates typical laboratory apparatus and carries out analyses to identify chemical compounds and materials, integrating computational methods and application software	Can use basic laboratory equipment and perform simple measurements and analyses for the characterization of selected coordination compounds, as well as process and interpret the obtained results using basic computational tools.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task

Subject contents

Course content – lecture

Fundamentals of coordination chemistry. Structure and classification of coordination compounds, central metal atoms and ligands, and isomerism. Theories of bonding in coordination compounds. Thermodynamics and kinetics of coordination compounds – equilibria in solution, stability, lability, and reactivity of complexes. Magnetic properties and electronic spectroscopy of coordination compounds. Fundamentals of organometallic chemistry – compounds containing metal–carbon bonds, their preparation, structure, properties, and applications. Fundamentals of bioinorganic chemistry and classification of bioelements. The role of s- and d-block elements in biological systems. The involvement of metals in biological processes, including photosynthesis, oxygen transport, nitrogen fixation, and electron transfer. Zinc-containing enzymes, zinc-finger structures, and metal-storage proteins. Metal compounds of therapeutic importance, including platinum, gold, and silver compounds. Fundamentals of synthetic bioinorganic chemistry and examples of its applications.

Course content – laboratory

Basic reactions of coordination compounds – formation of aqua, hydroxo, and ammine complexes, ligand exchange, and decomposition reactions of complexes. Preparation of selected nickel(II) complexes with chelating ligands. Basic methods for the isolation and characterization of the obtained coordination compounds, including determination of reaction yield, melting point measurement, and recording and interpretation of FT-IR spectra. Isolation of chlorophyll from plant material and spectrophotometric determination of chlorophyll a and b content. Analysis and interpretation of experimental results.

Course content – seminar

Independent preparation and presentation of a selected topic in coordination, organometallic, or bioinorganic chemistry based on scientific literature. Seminar topics include, among others, reactions of coordination compounds, the structure and applications of selected ligands and metal complexes, and the role of metals and coordination compounds in biological systems. Analysis and critical evaluation of information obtained from various scientific sources. Preparation and delivery of a presentation and participation in scientific discussion. Students may propose their own seminar topic related to the scope of the course.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Laboratory: entry tests and reorts	50.0%	30.0%
Seminar: assessment of presentation	50.0%	25.0%
Lecture – two written tests	50.0%	45.0%

Recommended reading	Basic literature	**A. Bielański: Fundamentals of Inorganic Chemistry, Wydawnictwo Naukowe PWN, 2010.** **P. Atkins, L. Jones, L. Laverman: General Chemistry, Wydawnictwo Naukowe PWN, 2020.** Z. Stasicka, G. Stochel (eds.): Fundamentals and Perspectives of Coordination Chemistry. Vol. I: Fundamentals of Coordination Chemistry, Wydawnictwo Uniwersytetu Jagiellońskiego, 2014. M.T. Cieślak-Golonka, J. Starosta, M. Wasielewski: Introduction to Coordination Chemistry, Wydawnictwo Naukowe PWN, 2014. S.J. Lippard, J.M. Berg: Principles of Bioinorganic Chemistry, Wydawnictwo Naukowe PWN, 1998.
	Supplementary literature	M.T. Cieślak-Golonka, J. Starosta, A. Trzeciak: Coordination Chemistry in Applications. Selected Topics, Wydawnictwo Naukowe PWN, 2019. H. Puzanowska-Tarasiewicz, M. Tarasiewicz: Chemistry of Coordination Compounds, Wydawnictwa Uniwersytetu Warszawskiego, 1993. K.J. Kettle: Physical Inorganic Chemistry: A Coordination Chemistry Approach, Wydawnictwo Naukowe PWN, 1999. R.M. Roat-Malone: Bioinorganic Chemistry, Wydawnictwo Naukowe PWN, 2010. R.W. Hay: Bio-Inorganic Chemistry, Wydawnictwo Naukowe PWN, 1990.
	eResources addresses	

Example issues/ example questions/ tasks being completed	Which of the following complexes do not exhibit geometrical isomerism (M – metal ion, A and B – ligands): a) MAB b) MA_2 c) square-planar MA_2B_2 d) octahedral MA_3B_3 In the ground state, the $[V(H_2O)_6]^{3}$ ion is: a) colored and diamagnetic b) colored and paramagnetic c) colorless and diamagnetic d) colorless and paramagnetic What is the maximum number of unpaired electrons that octahedral nickel(II) complexes can have in the ground state? a) 0 b) 1 c) 2 d) 4 e) 5 Name the coordination compound with the formula $[Co(NH_3)_6]SO_4$. Write the formula of sodium tetrachloronickelate(II). What is the dissociation constant of $[Ag(NH_3)_2]$ if its formation constant is 2.5×10^{7}? Write the ionic reaction equation for the formation of $[Cu(NH_3)_4]^{2}$.
Practical activites within the subject	Not applicable

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