GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Coordination and Bioinorganic Chemistry, PG_00053216		
Field of study	Chemistry		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2024/2025
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		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Anna Dołęga	
	Teachers	dr hab. inż. Łukasz Ponikiewski dr inż. Anna Ordyszewska dr inż. Daria Kowalkowska-Zedler prof. dr hab. inż. Anna Dołęga	

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						

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 equip students with he basic knowledge of coordination chemistry and bioinorganic chemistry.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	K6_W03	The student knows how the electronic configuration of transition metals determines the structure of coordination compounds and their physicochemical properties.	[SW1] Assessment of factual knowledge
	[K6_U03] can make detailed documentation of the results of self-conducted experiments and prepare a report describing these results	The student prepares a report on laboratory classes including a discussion of the obtained results	[SU5] Assessment of ability to present the results of task
	[K6_U02] can work individually and in a team; he/she can assess the necessary task time and plan and organize individual work and in a small team in a way that ensures the execution of the task within a set deadline	Student learns the basic notions connected with the coordination and bioinorganic chemistry during the lectures, prepares the seminar on a selected topic within seminars and cooperates within a small group within the laboratory.	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU5] Assessment of ability to present the results of task
	K6_W02	The student knows how the entropy and enthalpy factors influence the stability of the coordination compounds. The student knows and understands the influence of various electrostatic components on the stability of coordination compounds. The student understands the influence of the electronic structure of the coordination compound on its lability in solution.	[SW1] Assessment of factual knowledge

Subject contents

Lecture:

1. Fundamentals of coordination chemistry: theories of the structure of coordination compounds, isomerism.
2. Thermodynamics and kinetics - equilibrium in solutions of coordination compounds, stability and lability of complex compounds.
3. Structure and types of coordination relationships. Central atom and ligands.
4. Bonding theories, magnetic properties and electron spectroscopy of coordination compounds.
5. What is bioinorganic chemistry. Bioelements.
6. Bioinorganic chemistry of block s elements.
7. Chemistry of the elements of block p.
8. Manganese in photosynthesis - photosystem II
9. The role of iron in oxygen transport - hemoglobin.The role of iron (and molybdenum) in nitrogen fixation - nitrogenase. The role of iron in electron transfer.
10. Electron transfer and redox reactions - copper-containing proteins.
11. Zinc enzymes in proton and hydride transfer reactions. Zinc enzymes in bond hydrolysis reactions.
12. Zinc fingers
13. Other metals, metal-storing proteins
14. Metal compounds as drugs - cisplatin, gold compounds, silver compounds, etc.
15. Synthetic bioinorganic chemistry - examples.

Lab:

EXERCISE 1. Complex relationships - basic concepts and reactions

EXERCISE 2. Isolation of chlorophyll from selected plants.

EXERCISE 3. Preparation of selected coordination compounds. Synthesis and study of physicochemical properties.

Seminar: Presentations prepared by students on topics in the field of coordination and bioinorganic chemistry; sample topics:

1. Crown ethers - application
2. Koronand and cryptand - application
3. Porphyrins and corins
4. Siderophores
5. EDTA - properties and application
6. Transition metal cyanide complexes - examples and application
7. Metal complexes with hydrogen, nitrogen and oxygen
8. Clusters and nanoparticles - structure and application
9. Coordination polymers - structure and application
10. Gold complex compounds
11. Mercury complexes
12. Transport of metals in living organisms: transferrin, ferritin, ceruloplasmin, metallothioneins
13. Metal toxicity - mechanism: Hg, Pb, Tl

Prerequisites and co-requisites

None

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Seminars - presentation	50.0%	30.0%
Laboratories - experiments, reports	45.0%	30.0%
Lecture - tests	50.0%	40.0%

Recommended reading

Basic literature	1. Bielański A., Podstawy chemii nieorganicznej. PWN, Warszawa, 2010 2. Roat-Malone R.M.: Bioinorganic Chemistry. PWN, Warszawa, 2010
Supplementary literature	Maria Cieślak-Golonka, Dr Jan Starosta, Marek Wasielewski, Wstęp do chemii koordynacyjnej, PWN, Warszawa, 2021
eResources addresses	Adresy na platformie eNauczanie: 2024/25 Chemia koordynacyjna i bionieorganiczna dla kierunku Chemia semestr III - Moodle ID: 40621 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=40621

Example issues/ example questions/ tasks being completed	1. Why is copper hydroxide, insoluble in water, easily dissolved in ammonia solution? Write down the reaction equation. 2. What are chelate complexes? Give an example of such a complex - write down its formula. 3. Diaminadichloroplatin (II) has two isomers and diaminadichlorozinc (II) only one. What is the coordination geometry of these metal ions in the complex compounds mentioned? Draw and name both isomers of the platinum complex. 4. Using the example of tetraaminecopper(II) write down the steps of complex formation and the expression describing the cumulative stability constant of the complex. 5. The following is a spectrochemical series of ligands: **weak field ligands** $I^- < Cl^- < OH^- < F^- < H_2O < NH_3 < CO/ CN^-$ **strong field ligands**. Which of the following ligands is more likely to form a high-spin complex, Cl or CN^-? 6. In addition to a more intense color, the tetrahedral manganese (II) complexes are often green, while the octahedral complex $[Mn(H_2O)_6]^{2+}$ is pale pink. Why? 7. Calculate the concentrations of Ag^+ ions and NH_3 ammonia molecules present in a 0.01M $[Ag(NH_3)_2]Cl$, solution, which contains an additional 0.2 M ammonia. 8. The spin magnetic moment of the complex compound can be calculated from the number of unpaired electrons ("spin-only"). What is the approximate magnetic moment of the copper (II) complexes?
Work placement	Not applicable

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