



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 the 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 fulfillment [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	<p>Lecture:</p> <ol style="list-style-type: none"> <li>1. Fundamentals of coordination chemistry: theories of the structure of coordination compounds, isomerism.</li> <li>2. Thermodynamics and kinetics - equilibrium in solutions of coordination compounds, stability and lability of complex compounds.</li> <li>3. Structure and types of coordination relationships. Central atom and ligands.</li> <li>4. Bonding theories, magnetic properties and electron spectroscopy of coordination compounds.</li> <li>5. What is bioinorganic chemistry. Bioelements.</li> <li>6. Bioinorganic chemistry of block s elements.</li> <li>7. Chemistry of the elements of block p.</li> <li>8. Manganese in photosynthesis - photosystem II</li> <li>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.</li> <li>10. Electron transfer and redox reactions - copper-containing proteins.</li> <li>11. Zinc enzymes in proton and hydride transfer reactions. Zinc enzymes in bond hydrolysis reactions.</li> <li>12. Zinc fingers</li> <li>13. Other metals, metal-storing proteins</li> <li>14. Metal compounds as drugs - cisplatin, gold compounds, silver compounds, etc.</li> <li>15. Synthetic bioinorganic chemistry - examples.</li> </ol> <p>Lab:</p> <p>EXERCISE 1. Complex relationships - basic concepts and reactions</p> <p>EXERCISE 2. Isolation of chlorophyll from selected plants.</p> <p>EXERCISE 3. Preparation of selected coordination compounds. Synthesis and study of physicochemical properties.</p> <p>Seminar: Presentations prepared by students on topics in the field of coordination and bioinorganic chemistry; sample topics:</p> <ol style="list-style-type: none"> <li>1. Crown ethers - application</li> <li>2. Koronand and cryptand - application</li> <li>3. Porphyrins and corins</li> <li>4. Siderophores</li> <li>5. EDTA - properties and application</li> <li>6. Transition metal cyanide complexes - examples and application</li> <li>7. Metal complexes with hydrogen, nitrogen and oxygen</li> <li>8. Clusters and nanoparticles - structure and application</li> <li>9. Coordination polymers - structure and application</li> <li>10. Gold complex compounds</li> <li>11. Mercury complexes</li> <li>12. Transport of metals in living organisms: transferrin, ferritin, ceruloplasmin, metallothioneins</li> <li>13. Metal toxicity - mechanism: Hg, Pb, Tl</li> </ol>														
Prerequisites and co-requisites	None														
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="456 1576 794 1610">Subject passing criteria</th> <th data-bbox="799 1576 1137 1610">Passing threshold</th> <th data-bbox="1142 1576 1481 1610">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="456 1617 794 1650">Seminars - presentation</td> <td data-bbox="799 1617 1137 1650">50.0%</td> <td data-bbox="1142 1617 1481 1650">30.0%</td> </tr> <tr> <td data-bbox="456 1657 794 1691">Laboratories - experiments, reports</td> <td data-bbox="799 1657 1137 1691">45.0%</td> <td data-bbox="1142 1657 1481 1691">30.0%</td> </tr> <tr> <td data-bbox="456 1697 794 1711">Lecture - tests</td> <td data-bbox="799 1697 1137 1711">50.0%</td> <td data-bbox="1142 1697 1481 1711">40.0%</td> </tr> </tbody> </table>			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%
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Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> <li>1. Why is copper hydroxide, insoluble in water, easily dissolved in ammonia solution? Write down the reaction equation.</li> <li>2. What are chelate complexes? Give an example of such a complex - write down its formula.</li> <li>3. Diamminedichloroplatin(II) has two isomers and diamminedichlorozinc(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.</li> <li>4. Using the example of tetraamminecopper(II) write down the steps of complex formation and the expression describing the cumulative stability constant of the complex.</li> <li>5. The following is a spectrochemical series of ligands: <b>weak field ligands</b> <math>I^- &lt; Cl^- &lt; OH^- &lt; F^- &lt; H_2O &lt; NH_3 &lt; CO / CN^-</math> <b>strong field ligands</b>. Which of the following ligands is more likely to form a high-spin complex, <math>Cl^-</math> or <math>CN^-</math>?</li> <li>6. In addition to a more intense color, the tetrahedral manganese(II) complexes are often green, while the octahedral complex <math>[Mn(H_2O)_6]^{2+}</math> is pale pink. Why?</li> <li>7. Calculate the concentrations of <math>Ag^+</math> ions and <math>NH_3</math> ammonia molecules present in a 0.01M <math>[Ag(NH_3)_2]Cl</math> solution, which contains an additional 0.2 M ammonia.</li> <li>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?</li> </ol>
Work placement	Not applicable

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