GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00059021		
Field of study	Nanotechnology		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2024/2025
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study 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	5.0
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. Jarosław Chojnacki	
	Teachers	dr hab. Katarzyna Kazimierczuk dr inż. Anna Ordyszewska prof. dr hab. inż. Jarosław Chojnacki	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	30.0	0.0	0.0	60

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	60	5.0	60.0	125

Subject objectives

The lecture and laboratory experiments are aimed at demonstration on selected examples how the properties of the elements and their compounds including coordination compounds can be traced in nature and used in man-made products, especially in nonotechnology. Additioanal goal is consolidation of the chemical knowledge gained in previous semesters.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_W05	Student knows the properties of the elements, and reactions leading to coordination compounds, is aware of the influence of structure on their properties. He gives examples of importance of coordination compounds in chemistry including chemistry of nanomaterials. He knows the chemical basis for obtaining and modifying materials important in nanotechnology (aerogels, xerogels etc.).	[SW1] Assessment of factual knowledge
K6_U04	Student can perform basic experiments in a chemical laboratory. He prepares reliable reports on the experiments carried out.	[SU1] Assessment of task fulfilment
K6_U01	The student knows how to obtain information from literature and other sources on a given topic, especially related to the laboratory task performed.	[SU1] Assessment of task fulfilment

<table>
<tr><td>Subject contents</td><td>Lecture:

1. Chemical bonds and interactions. Crystals. Colour and photonic crystals.
2. Paint pigments - their history and present day, types.
3. Silicates, Silica aerogels. Natural microsilica structures - diatoms.
4. Silicones - genesis, structure, preparation, properties and use.
5. Oxygen. Different forms. Ionic oxides, peroxides and superoxides - structure, properties and use.
6. Different forms of elements - from mono- to polyatomic species. Phosphorus allotropy.
7. Covalent oxides - nitrogen oxides in nature and technology.
8. Coordination compounds, their isomerism. Properties of d- and f-block of elements.
9. Acids, polyacids and their salts.
10. Hybrid organic-inorganic materials. Coordination polymers and MOF's.
11. Basics of crystal engineering.
12. Introduction to supramolecular chemistry.
13. Two lectures based on actual science findings and relevant literature data. "Hot" topics.

Laboratory experiments (subjects):

1.Redox reactions
2.Coordination compounds
3.Qualitative analysis of selected ions
4.Chemical route to the "nanoworld"
5.Acid-base properties of chemical compounds
6.Selected aspects of crystallization</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>"General and Inorganic Chemistry" sem I and "Basics of Organic and Physical Chemistry" sem II, passed</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>lecture: written test</td><td>60.0%</td><td>50.0%</td></tr>
<tr><td>introductory tests and detailed reports</td><td>50.0%</td><td>50.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>Maria Cieślak-Golonka, Jan Starosta, Anna Trzeciak, "Coordination chemistry in applications", Wydawnictwo Naukowe PWN 2019 (in Polish)

Chemistry: Molecules, Matter, and Change, Fourth Edition, by Loretta Jones and Peter Atkins, Publisher: W. H. Freeman; 4th edition (January 1, 2000)

Maria Cieślak-Golonka, Jan Starosta, Marek Wasielewski "Introduction to coordination chemistry", Wydawnictwo Naukowe PWN 2010, (in Polish)

Online: materials published in moodle course (descriptions of laboratory experiments (in Polish))</td></tr>
<tr><td>Supplementary literature</td><td>G.R. Desiraju, J.J. Vittal, A. Ramanan "Crystal Engineering. A textbook." WorldScientific, 2011

Concepts of Nanochemistry, Cademartiri Ludovico, Ozin Goeffrey A., Wiley, 2009</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:
Chemia strukturalna i koordynacyjna - 2024/25 - Moodle ID: 39855
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=39855</td></tr>
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Example issues/ example questions/ tasks being completed	**Lecture test - selected examples:** 1. Give the electronic configuration of O_2^{2-} using LCAO method. 2. Explain the influence of Si/Al ratio on properties of zeolites. 3. Give examples of intermolecular and intramolecular hydrogen bonding. 4. Helium - its sources and use. 5. What is the halogen bonding? 6. Which elements form covalent oxides? How these oxides usually react with water? 7. Characterize structure of silicates. 8. Describe the chemistry of obtaining silica aerogels. 9. Why there is one type of $ZnCl_2(NH_3)_2$ and two types of $PtCl_2(NH_3)_2$? Short laboratory test questions are closely related to the appropriate exercise topics.
Work placement	Not applicable

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