



## Subject card

Subject name and code	, PG_00052072						
Field of study	Nanotechnology						
Date of commencement of studies	October 2020	Academic year of realisation of subject			2021/2022		
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			blended-learning		
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	prof. dr hab. inż. Jarosław Chojnacki dr hab. Katarzyna Kazimierczuk dr inż. Anna Ordyszewska					
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: 28.0						
	Address on the e-learning platform: <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=6359">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=6359</a> Adresy na platformie eNauczanie: CHEMIA III - Moodle ID: 6359 <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=6359">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=6359</a>						
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 can be traced in nature and used in man-made products.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	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
	K6_W05	Student knows the properties of the elements, the influence of structure on these properties and their importance in everyday life. He gives examples of the biochemical significance of elements. Appreciates the global (or local) effects that are the result of uncontrolled introduction into the environment of certain chemicals (ozone, CO <sub>2</sub> , freons, SO <sub>x</sub> ). 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
Subject contents	<p><b>Lecture:</b></p> <ol style="list-style-type: none"> <li>1. Chemical bonds and interactions. Crystals. Colour and photonic crystals.</li> <li>2. Blue paint pigments - their history and present day, types.</li> <li>3. Silicates, Silica aerogels. Natural microsilica structures - diatoms.</li> <li>4. Silicones - genesis, structure, preparation, properties and use.</li> <li>5. Oxygen. Ionic oxides, peroxides and superoxides - structure, properties and use.</li> <li>6. Ozone and its role in troposphere and stratosphere. Acid rain effects.</li> <li>7. Different forms of elements - from mono- to polyatomic species. Phosphorus allotropy.</li> <li>8. Covalent oxides - nitrogen oxides in nature and technology.</li> <li>9. Properties of d- and f-block of elements. Coordination compounds.</li> <li>10. Acids, polyacids and their salts.</li> <li>11. Coordination polymers and MOF's.</li> <li>12. Introduction to supramolecular chemistry.</li> <li>13. Two lectures based on actual science findings and relevant literature data. "Hot" topics.</li> </ol> <p><b>Laboratory experiments (subjects):</b></p> <ol style="list-style-type: none"> <li>1.Redox reactions</li> <li>2.Cordination compounds</li> <li>3.Qualitative analysis of selected ions</li> <li>4.Chemical route to the "nanoworld"</li> <li>5.Acid-base properties of chemical compounds</li> <li>6.Selected aspects of crystallization</li> </ol>		
Prerequisites and co-requisites	Chemistry II, passed		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	introductory tests and detailed reports	50.0%	50.0%
	lecture: written test	60.0%	50.0%
Recommended reading	Basic literature	<i>Chemistry: Molecules, Matter, and Change</i> , Fourth Edition, by Loretta Jones and Peter Atkins, <b>Publisher:</b> W. H. Freeman; 4th edition (January 1, 2000)  Online: materials published in moodle course (descriptions of laboratory experiments (in Polish))	
	Supplementary literature	Concepts of Nanochemistry, Cademartiri Ludovico, Ozin Goeffrey A., Wiley, 2009	
	eResources addresses	CHEMIA III - Moodle ID: 6359 <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=6359">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=6359</a>	

<p>Example issues/ example questions/ tasks being completed</p>	<p><b>Lecture test - selected examples:</b></p> <ol style="list-style-type: none"> <li>1. Give the electronic configuration of <math>O_2^{2-}</math> using LCAO method.</li> <li>2. Which of the two compounds, HF or HCl, has greater heat of vaporization? Provide an explanation.</li> <li>3. What is the role of chlorine in the ozone hole formation?</li> <li>4. Helium - its sources and use.</li> <li>5. What is the ozone role in the troposphere (the layer close to the earth surface)?</li> <li>6. Which elements form covalent oxides? How these oxides usually react with water?</li> <li>7. Characterize silicates.</li> <li>8. Describe the properties and use of a selected nitrogen oxide.</li> </ol> <p>Short laboratory test questions are closely related to the appropriate exercise topics.</p>
<p>Work placement</p>	<p>Not applicable</p>