



## Subject card

Subject name and code	Chemistry, PG_00037262						
Field of study	Technical Physics						
Date of commencement of studies	October 2022	Academic year of realisation of subject			2022/2023		
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	1	Language of instruction			Polish		
Semester of study	2	ECTS credits			4.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Chemistry and Technology of Functional Materials -> Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Elżbieta Luboch					
	Teachers	prof. dr hab. inż. Elżbieta Luboch dr inż. Radosław Pomećko dr inż. Mariusz Szkoda Zuzanna Zarach dr inż. Konrad Trzciński dr inż. Natalia Łukasik					
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		35.0	100	
Subject objectives	The main goal of the course is to consolidate knowledge of students in general chemistry.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	K6_U04	The student has experience in working in a chemical laboratory			[SU4] Assessment of ability to use methods and tools		
	K6_W12	The student knows general chemistry. The student also knows the basic principles of work safety in a chemical laboratory.			[SW1] Assessment of factual knowledge		

Subject contents	<p>Periodic table of elements. Electron configurations of atoms. Periodic changes of some quantities: ionization energy of elements, electron affinity, electronegativity of elements. Atomic and ionic radius. Basic chemical laws, formulas and chemical equations. Chemical bonds: main types of bonds. Covalent bond: description of electrons in molecules considered on the basis of the electronic theory of chemical bonding and the theory of molecular orbital. Binding and anti-bonding orbitals. The shapes of the molecular orbital regions: molecular <math>\sigma</math> and <math>\pi</math> type orbitals. Electronic configuration of molecules. The concept of orbitals hybridization. Explanation of the shape of molecules based on the concept of hybridization. Delocalized bonds. Aromatic compounds: properties, examples. Explanation of the shape of molecules - VSEPR method. Polarization of chemical bonding. Intermolecular interactions. Hydrogen bonding and its effect on the physical properties of chemical compounds. General characteristics of the states of matter. Solid: crystallographic systems, elementary cell types, ionic, covalent, molecular and metallic crystals. The crystal structure and the physical properties of the substance. Types of chemical reactions. Nomenclature of inorganic compounds. Properties of particular groups of inorganic compounds. Coordination binding. Complex compounds: the concept of a central atom and ligand, examples of complex compounds and their names, properties of complex compounds and their importance. Complex compounds - the theory of the crystalline field. Organic compounds: classification, nomenclature, isomerism, properties, reactivity. Mechanisms of reaction of organic compounds. Aromatic electrophilic substitution. Polymer synthesis methods. The structure of the polymer and its properties. Biologically important macromolecules: the structure of proteins and nucleic acids. Chemical thermodynamics - basic concepts, the first principle. Enthalpy of physical changes and chemical reactions. The second law of thermodynamics: entropy, free enthalpy, free enthalpy of reaction, spontaneous processes, reactions in a state of equilibrium. Solutions, types of solutions. Chemical equilibrium. Balance in aqueous solutions. Electrolyte solutions. Ion and proton theory of acids and bases. The concept of pH. Low electrolytes. Hydrolysis. Ostwald's dilution law. Buffer solutions. Electronic theory of acids and bases, HSAB theory. Strong electrolytes, the concept of ionic activity and strength. Chemical kinetics. Effect of concentrations of reacting substances on the reaction rate. The influence of temperature. The role of the catalyst. Chemical qualitative and quantitative analysis. Oxidation and reduction reactions. Oxidation state. Cell. Electrode potential. The Nernst pattern. Half cell. Definition of relative electrode potential. Half-cell of the first type. A series of electrochemical metals. Half-cell of the second type. Redox half-cell. Membrane electrodes. Electrolysis.</p>		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Passing the lecture	50.0%	50.0%
	Passing laboratory exercises	50.0%	50.0%
Recommended reading	Basic literature	<p>1. L. Jones, P. Atkins „Chemia ogólna. Czasteczki, materia, reakcje” PWN 2009. 2. A. Bielański „Podstawy chemii nieorganicznej” PWN 2002. 3. F.A. Cotton, G. Wilkinson, P.L. Gaus „Chemia nieorganiczna. Podstawy” PWN 2002. 4. P.W. Atkins „Podstawy chemii fizycznej” PWN 1999. 5. J. McMurry „Chemia organiczna” PWN 2005. 6. E. Luboch, M. Bocheńska, J.F. Biernat (red.) „Chemia ogólna. Ćwiczenia laboratoryjne”, Wyd. PG 2003.</p>	
	Supplementary literature	<p>1. W. Kołos, J. Sadlej „Atom i cząsteczka” WNT 2007. 2. P.W. Atkins „Przewodnik po chemii fizycznej” PWN 1997. 3. A. Cygański „Metody elektroanalityczne” WNT 1995.</p>	
	eResources addresses	Adresy na platformie eNauczenie:	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		