GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Inorganic chemistry, PG_00057666		
Field of study	Green Technologies		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2024/2025
Education level	first-cycle studies	Subject group	Obligatory subject group 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	1	ECTS credits	5.0
Learning profile	general academic profile	Assessment form	exam
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 inż. Daria Kowalkowska-Zedler 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	30.0	0.0	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	10.0	80.0	150

Subject objectives

The aim of the course is to teach students the direction of Zielone Technologie of the broadly understood basis of chemistry.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W02] has a basic knowledge of chemistry including general chemistry, inorganic, organic, physical, analytical, including the knowledge necessary to describe and understand the phenomena and chemical processes occurring in the environment; measurement and the determination of the parameters of these processes.	Student can invoke and apply the basic laws and definitions of general and inorganic chemistry to explain chemical processes occuring in the environment and technological processes.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
[K6_U05] can formulate and solve engineering tasks analytical methods, simulation as well as experimental, able to apply knowledge of basic physics and mathematics to analyze the results of experiments, is able to analyze and assess existing technical solutions	Student is able to apply the aquired knowledge in the field of inorganic chemistry and combine it with the foundations of physics and mathematics.	[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools
[K6_W01] has a basic knowledge from some branches of mathematics and physics useful for formulating and solving simple problems in the field of environmental technologies and modern analytical methods	The student has the basic physical and mathematical knowledge necessary to solve balance tasks in chemistry and problems related to chemical equilibrium processes.	[SW1] Assessment of factual knowledge

Subject contents	Lecture 1. Basic concepts and chemical laws: What is chemistry? Chemical substance, elements and chemical compounds. Elemental particles, atoms and molecules. Mole. Atomic mass. Molar mass for atoms and molecules. Law of conservation of mass and energy. The law of constant and multiple proportions. The law of simple volumetric proportions for gases. Chemical compound and mixture. Solutions. Ways of expressing composition and concentration. 2. Chemical reactions: Chemical equations. Types of chemical reactions: synthesis, analysis, and replacement. Combustion reaction. The reactions occurring in solutions and precipitation. Acid-base reactions. Oxidation and reduction reactions. Endo- and exothermic reactions. Photochemical reactions. Stoichiometry, nomenclature of chemical compounds: Nomenclature principles for popular inorganic compounds. Common and systematic names of hydrides, oxides, hydroxides, acids and salts. Nomenclature of selected groups of organic compounds. Structural and spatial isomerism. Positional isomerism for functional groups. Geometric isomorphism and optical isomers. Empirical formula and molecular formula. Determination of molecular mass. 3. Electronic structure of atom and periodic system: Quantization of energy. Absorption spectra and spectrum of emission. Planck condition. Bohr model of the hydrogen atom. Wave-particle duality: de Broglie waves. Spin of electron. Heisenberg's uncertainty principle. Wave function and its physical meaning. Schrödinger equation and solution ideas. Quantum numbers. Radial distribution function. Atomic orbitals. Principles of electron shell extension: Hund's rule and Pauli exclusion principle. Hydrogen atom. Hydrogen-like atoms. Multi-electron atoms. Electron configurations of atoms. Periodic table. Periodicity of properties. Ionization potential. Atomic radia. Electronegativity. Electron affinity. Hydrides and oxides. Oxidation state. 4. Chemical bonds, chemical compounds - structure and properties. Polarization of bonds. MO theory, symmetry and types of molecular orbitals (LCAO). The theory of valence bonds (VB). Hybridization of orbitals and geometry of molecules. VSEPR method. Delocalized bonds. Metallic bonding, hydrogen bonding, van der Waals interactions. Bonding and geometry relations. 5. Acid-base reactions in solutions: Aqueous solutions. Electrolytes and non-electrolytes. Electrolytic dissociation. Equilibria in electrolyte solutions. Ionisation constant and degree of ionisation. Activity and activity factor. Ionic strength. Solubility product and activity product. Acids, bases, salts. Acidity theories: Arrhenius, Brønsted, Lewis. Acid base equilibria: amphoteric properties, hydrolysis, buffers, theory of indicators. 6. Foundations of thermochemistry. Heat of reaction, internal energy, enthalpy, Hess law. Chemical kinetics, mechanism and kinetic order of reaction. 7. Electrochemistry. Generation of electrical potential at electrodes, reducers and oxidizers. Electrochemical cells. Standard potentials. Electrolysis. Corrosion processes. 8. Crystal chemistry. Polymorphism and allotropy, isomorphism. Tutorials Basic concepts and chemical laws: chemical substance, elements and chemical compounds. The law of mass conservation. The law of constant and multiple proportions. The Avogadro's law. Atom and molecule. Mole. Atomic mass. Molar mass of atoms and molecules. Determination of the simplest formula and molecular formula. Gas laws. The ideal gas equation. Repetition of the nomenclature of basic inorganic compounds. Traditional names and systematic names of hydrides, oxides, hydroxides, acids and salts. Nomenclature of selected groups of organic compounds. Chemical compound and a mixture. Stoichiometry and chemical reactions: balancing coefficients in chemical equations. Solutions. Expressions of composition and concentration: mass percentage, mole fraction, units of concentration and their conversion (%, mol, ppm, ppb).
Prerequisites and co-requisites	no requirements
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
lecture: written exam	60.0%	60.0%
exercise: three written tests	60.0%	40.0%

Recommended reading	Basic literature	1. Bielański A., Podstawy chemii nieorganicznej. PWN, Warszawa, 2010 oraz wydania wcześniejsze. 2. Jones L., Atkins P.: Chemia ogólna.PWN, Warszawa, 2004 oraz wydania następne. 3. Cox P.A.,Krótkie wykłady. Chemia Nieorganiczna, PWN, Warszawa, 2003. 4.KChN PG, skrypt on-line https://chem.pg.edu.pl/kchn/dydaktyka/skrypt-do-cwiczen
	Supplementary literature	1. Pazdro K., Rola-Noworyta A. Akademicki zbiór zadań z chemii ogólnej. OE Pazdro, Warszawa 2013. 2. Atkins P.: Podstawy chemii fizycznej. PWN, Warszawa, 2009. 3.SienkoM., Plane R.: Chemia. Podstawy zastosowania. PWN,Warszawa,1993. 4. Pajdowski L.: Chemia ogólna. PWN, Warszawa,1999. 5. Kolditz L. (Ed.): Chemia nieorganiczna. PWN, Warszawa,1994. 6. Praca zbiorowa (Chmurzyński L., Gleich E., Myszka H.,Nesterowicz M., Smiatacz K., Widernik T.: Obliczenia z chemii ogólnej. Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk 2007
	eResources addresses	Adresy na platformie eNauczanie: Chemia nieorganiczna dla kierunku Zielone Technologie, 2024/25 - Moodle ID: 40303 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=40303
Example issues/ example questions/ tasks being completed	1. Describe the difference between the simplest formula and molecular formula. Give an example. 2. What molecular geometry predicts the VSEPR theory for SeF_4? 3. Balance the given redox reaction 4. Calculate molar concentration of 36% solution of HCl if its density equals to 1,18 g/cm^3. 5. Write the electron configuration for given atoms and ions: Cl, N, Na^+, O^{2-} 6. Draw Lewis structures (dot formulas) for SO_2; N_3^-	
Work placement	Not applicable	

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