GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	BASICS OF CHEMISTRY, PG_00064368						
Field of study	Chemistry						
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	dr hab. inż. Rafał Grubba					
	Teachers	dr hab. inż. Łukasz Ponikiewski dr hab. inż. Rafał Grubba					
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	55.0		125
Subject objectives	Mastery of basic notions of general chemistry and periodic table.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U04] creates detailed documentation of the results obtained from the experiments carried out individually or as part of a team, analysing and interpreting the results in the form of text documents, spreadsheets, graphs, technological diagrams, multimedia presentations using correct chemical nomenclature	Is able to prepare reports on completed tasks using the acquired theoretical knowledge and using correct chemical nomenclature.	[SU5] Assessment of ability to present the results of task [SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment
[K6_K01] understands the need for continuous learning, can inspire and organise learning and others, understands the importance of group and team activities	He has a habit of constant education, and also understands the need to develop professional, personal, and social competences.	[SK3] Assessment of ability to organize work [SK1] Assessment of group work skills
[K6_U01] gathers information from literature, databases and other sources, interpreting, critically evaluating, summarising, formulating and justifying opinions, independently analyses and produces technical drawings with the use of computer assistance	The student characterizes the elements chemical using periodic table. Student describes the electronic structure atom or ion according to the Pauli's law and Hund's rule. The student is able to design synthesis of simple compounds main group elements.	[SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information
[K6_W02] classifies acquired information, assessing its usefulness in solving the posed problems concerning the synthesis and analysis of selected groups of compounds, determining their physical and chemical properties, making measurements and determining the parameters of chemical reactions and processes	The student describes the structures electronic covalent chemical compounds using Lewis bonding theory and the octet rule. The student predicts the shape molecules of compounds covalent using VSEPR model. Student provides some properties compounds of group elements main ones based on the Lewis structure.	[SW1] Assessment of factual knowledge

Subject contents

Lecture:

1. Atoms and molecules. Masses and sizes of atoms. Chemical element, isotope, atomic number and mass number. the mole, Avogadro number.
2. States of matter and their properties.
3. The structure of an atom. Radioactivity. Subatomic particles.
4. Electronic structure of atoms. de Broigle equation, Heisenberg uncertainty principle, qualitative description of an atom according to Schrödinger theory. Quantum numbers, orbitals, Pauli exclusion principle and Hund's rule. Valence electrons. Electronic configuration for atoms and ions.
5. Trends in the periodic table of the elements
6. Chemical reactions, their types and their energetic effects. Reaction rate. Reversible reactions.
7. Chemical bonding. Classification of chemical bonds. Hybridisation of orbitals, Lewis structures of covalent compounds. Geometry of molecules or ions based on VSEPR concept. Molecular orbitals and LCAO method for diatomic homonuclear compounds of 2nd row elements. The bond order. Intermolecular interactions.
8. Classification of inorganic chemical compounds: hydrides, oxides, acids, bases, salts. Amfoteric properties.
9. Properties of hydrogen, oxygen, ozone, water and hydrogen peroxide. Allotropy and isomorphism.
10. Properties of solutions. Hardness of water.

Seminars:
1. Basic laws and principles in chemistry
2. Quantitative aspects of metter (mole). Calculations based on the mole concept.
3. Gas laws
4. Lewis structures for molecules and ions.
5. Formulas from composition percentage
6. Determination of chemical formulas based on analytical results
7. Balancing of chemical reactions especially redox reactions.
8. Calculation of mass, volume, number of moles of products based on the equation of chemical reaction. Yield calculation.
9. Chemical equivalent for different types of chemical reactions. Application of this term to stoichiometric calculations
10. Solutions, percentage concentration, molar concentration, ppm, ppb.

Prerequisites and co-requisites

The knowledge of chemistry at the level of secondary school is required.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Passing the exercises	60.0%	33.0%
Lecture - final exam	60.0%	67.0%

Recommended reading

Basic literature	1. L. Jones, P. Atkins. Chemia Ogólna. Wydawnictwo Naukowe PWN, Warszawa 2004. 2. K.M. Pazdro. Podstawy Chemii dla kandydatów na wyższe uczelnie.
Supplementary literature	A. Bielański. Podstawy Chemii Nieorganicznej. Wydawnictwo Naukowe PWN, Warszawa 2007.
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed

1. Define the Avogadros number. Calculate how many methane molecules contains 1000 m^3 of this gas under normal conditions. Calculate the mass (kg) of this volume of methane.
2. Please define the mass number and the atomic number. How many protons, neutrons and electrons contains:

a) $^{96}_{44}Ru$ b) $^{104}_{44}Ru$ c) $^{96}_{44}Ru^{2+}$ d) $^{96}_{44}Ru^{2}$

3. Complete the following combustion equations:

a) $Mg + O_2 =$

b) $K + O_2 =$

c) $Na + O_2 =$

d) $Li + O_2 =$

4. Write the Lewis formula of ionic potassium sulfide.

5. Indicate the valence electrons for Pb, Pb^{2+}, Pb^{4+} and for Au, Au^{+} and Au^{3+}.

6. Describe detailed the industrial methods of hydrogen production. Write the adequate chemical equations.

7. Using the molecular orbital energy diagram explain the configuration of valence electrons in O_2. Calculate the bond order in this anion.

8. Draw the Lewis structures and describe the shapes of molecules (ions) for: SO_3^2, SF_4, BeF_3, HCO_3.

9. Complete the following chemical equations:

a) $Al + NaOH + H_2O$

b) $KH + H_2O$

c) $Mg + H_2O$

10. Please discuss the Gay-Lussac law off combining volumes. we combust 2 dm^3 of ethene C_2H_4. The product of this combustion is carbon monooxide and water. Calculate the volume of used oxygen.

11. Discuss the Hunds rule. Estimate the electron configuration for cation Fe^{3+}.

Work placement

Not applicable