GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Chemistry, PG_00068168		
Field of study	Biomedical Engineering		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2025/2026
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	1	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 -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Ewa Wagner-Wysiecka	
	Teachers	dr inż. Mariusz Szkoda dr inż. Konrad Trzciński dr inż. Radosław Pomećko prof. dr hab. inż. Ewa Wagner-Wysiecka prof. dr hab. Anna Lisowska-Oleksiak	

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

eNauczanie source addresses:

Moodle ID: 25261 CHEMIA dla Inżynierii Biomedycznej 25/26
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=25261

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 objective of the course is to introduce students to the fundamental concepts and laws of general and organic chemistry, with particular emphasis on issues relevant to biomedical engineering. The student acquires knowledge about the structure of atoms and molecules, types of chemical bonds, reaction kinetics and thermodynamics, chemical equilibrium, electrochemical processes, as well as the properties and reactivity of inorganic, organic, and biologically important compounds. The student also develops the ability to interpret chemical phenomena and to apply chemical knowledge in the area of biomedical engineering.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U09] can carry out a critical analysis of the functioning of existing technical solutions and assess these solutions, as well as apply experience related to the maintenance of technical systems, devices and facilities typical for the field of studies, gained in the professional engineering environment	The student is able to use chemical knowledge to analyse the properties of materials and compounds used in biomedical engineering and to assess their suitability in existing technical solutions, taking into account durability, reactivity, safety, and interactions with biological systems.	[SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment
[K6_W52] Knows and understands, to an advanced extent, selected aspects of chemistry and biochemistry, constituting general knowledge related to the field of study	The student knows and understands selected issues in general and bioorganic chemistry.	[SW1] Assessment of factual knowledge
[K6_K02] is ready to critically assess possessed knowledge and acknowledge the importance of knowledge in solving cognitive and practical problems	The student understands the importance of knowledge in solving cognitive and practical problems.	[SK5] Assessment of ability to solve problems that arise in practice
[K6_W02] knows and understands, to an advanced extent, selected laws of physics and physical phenomena as well as methods and theories explaining the complex relationships between them, constituting the basic general knowledge in the field of technical sciences related to the field of study	The student can justify the properties of the substance knowing the characteristics of the elements and the way they are combined.	[SW1] Assessment of factual knowledge

Subject contents

LECTURE:Periodic table of elements. Electronic configuration of atoms. Periodic changes in certain quantities: ionisation energy of elements, electron affinity, electronegativity of elements. Atomic and ionic radii. Definitions of certain fundamental terms. Fundamental laws of chemistry, chemical formulae and equations. Chemical bonds: main types of bonds. Covalent bond: description of electrons in molecules based on the electron theory of chemical bonds and theory of molecular orbitals. Bonding and anti-bonding orbitals. Shapes of molecular orbital areas: σ and π molecular orbitals. Electronic configuration of molecules. Hybridisation of orbitals. Explanation of shapes of molecules based on hybridisation. Delocalised bonds. Aromatic compounds: properties, examples. Explanation of molecule shapes: VSEPR method. Polarisation of chemical bonds. Inter-molecular interactions. Hydrogen bond and its effects on chemical compound physical properties. Types of chemical reactions. Oxidation and reduction reactions. Oxidation state. Nomenclature of inorganic compounds. Properties of inorganic compounds. Coordination bond. Complex compounds: notion of the central atom and the ligand, examples of complex compounds and their names; properties of complex compounds and their role. Organic compounds: classification, nomenclature. Biologically important organic compounds. Organic compounds: properties, reactivity. Mechanisms of organic compound reactions. Chemical thermodynamics: basic terms, first law. Enthalpy of physical changes and chemical reactions. Second law of thermodynamics: entropy, free energy, free energy of reaction, spontaneous processes, equilibrium reactions. Solutions, types of solutions. Properties of water. Physical properties of solutions. Chemical equilibrium. Equilibrium in aqueous solutions. Electrolyte solutions. Ionic and proton theory of acids and bases. pH. Weak electrolytes. Hydrolysis. Ostwalds dilution law. Buffer solutions. Electron theory of acids and bases, HSAB theory. Strong electrolytes, ionic activity and strength. LABORATORY:Concentration of solutions. Acidity of solutions. Qualitative analysis of cations. Qualitative analysis of anions. Kinetics of chemical reactions. Catalysis in the synthesis of organic compounds. Extraction. Resolution of substances. Precipitation processes. Water demineralisation methods. Colloids. Chromatography. Redox reactions. Electrochemical series of metals. Cells. Corrosion.

Prerequisites and co-requisites

No requirements

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Written test	50.0%	50.0%
Laboratory – completion of all practical sessions, submission of required reports, and passing short tests	50.0%	50.0%

Recommended reading

Basic literature	1. P. Atkins,L. Jones Chemia ogólna. Cząsteczki, materia, reakcje PWN 2014. 2. A. Bielański Podstawy chemii nieorganicznej PWN 2013. 3. F.A. Cotton, G. Wilkinson, P.L. Gaus Chemia nieorganiczna. Podstawy PWN 2002 4. T. Kędryna Chemia ogólna z elementami biochemii ZamKor 2004 5. M.J. Sienko, R.A. Plane Chemia. Podstawy i zastosowania WNT 2002 6. L. Pajdowski Chemia ogólna PWN 1999 7. W. Gałasiński Chemia medyczna PZWL 2004 8. P.W. Atkins Podstawy chemii fizycznej PWN 1999 9. J. McMurry Chemia organiczna PWN 2005 10. red. E. Luboch, M. Bocheńska, J.F. Biernat Chemia ogólna. Ćwiczenia laboratoryjne Wyd. PG 2003
Supplementary literature	1. W. Kołos, J. Sadlej Atom i cząsteczka WNT 2007 2. P.W. Atkins Przewodnik po chemii fizycznej PWN 1997 3. P.W. Atkins Chemia fizyczna PWN 2007 4. P. Mastalerz Chemia organiczna Wyd. Chemiczne 2002 5. A. Cygański Metody elektroanalityczne WNT 1995

	eResources addresses	
Example issues/ example questions/ tasks being completed	1. Into which blocks can the periodic table of elements be divided? How do the atoms in each block differ? 2. What is the relationship between an elements position in the periodic table and its chemical reactivity and properties? 3. What is the nature of coordinate (dative) bond formation? Give an example. 4. Calculate the pH of a hydrochloric acid solution with a concentration of 0.001 mol/dm^3. 5. What is corrosion protection? What methods can be used to partially prevent the corrosion of base metals? 6. Aniline was added to a test tube containing water. What pH will the solution exhibit, and why?	
Work placement	Not applicable	

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