


KAPITAŁ LUDZKI
 NARODOWA STRATEGIA SPÓJNOŚCI

 Projekt współfinansowany przez
 Unię Europejską w ramach
 Europejskiego Funduszu
 Społecznego

UNIA EUROPEJSKA
 EUROPEJSKI
 FUNDUSZ SPOŁECZNY


Course title		ECTS code	
Physicochemistry and life		13.3.1209	
Name of unit administrating study			
null			
Studies			
faculty	field of study	type	first tier studies (BA)
Faculty of Chemistry	Chemical Business	form	full-time
		specjalty	all
		specialization	all
Faculty of Chemistry	Chemistry	type	first tier studies (BA)
		form	full-time
		specjalty	all
Faculty of Chemistry	Environmental Protection	specjalty	all
		specialization	all
		type	first tier studies (BA)
		form	full-time
		specjalty	all
		specialization	all
Teaching staff			
dr hab. Karol Krzywiński, profesor uczelni; dr hab. Piotr Storonik, profesor uczelni			
Forms of classes, the realization and number of hours		ECTS credits	
Forms of classes		4 classes - 30 h tutorial classes - 30 h student's own work - 40 h TOTAL: 100 h - 4 ECTS	
Lecture			
The realization of activities			
lectures in the classroom			
Number of hours			
Lecture: 30 hours			
The academic cycle			
2023/2024 summer semester			
Type of course		Language of instruction	
- an elective course - obligatory		english	
Teaching methods		Form and method of assessment and basic criteria for evaluation or examination requirements	
Lecture with the use of the multimedia presentation on the basic issues of general physical chemistry. During the classes students will learn about various aspects of physical chemistry with an emphasis on their practical context. Various practical problems will be discussed and solved with the teacher's guidance during the lectures.		Final evaluation	
		Graded credit	
		Assessment methods	
		exam with the test questions and open problem questions (50%/50%).	
		The basic criteria for evaluation	
		Lecture: positive note from an exam with 10 test questions and 10 open questions. Grading scale: 91-100%: 5.0 81-90%: 4.5 71-80%: 4.0 61-70%: 3.5 51-60%: 3.0 < 51%: 2.0 Positive grade for the written exam consisting of 10 test and 10 open questions covering only the issues mentioned in the lecture course; Assessment criteria in accordance with the University of Gdańsk Study Regulations.	
Method of verifying required learning outcomes			

Business Chemistry:

The method of verifying the acquisition of knowledge: Written exam in the field of practical physical chemistry. The student proposes solutions of the problems in the above field of raised by the lecturer in an open discussion (K_BCh_W02). During the exam, the student describes relationships among economics, chemical industry and the physicochemistry of discussed processes (K_BCh_W04). The method of verifying the acquisition of skills: Assessment of the student's involvement in discussions on the issues related to the above subject (K_BCh_U01). Drawing observations and conclusions from the experiments presented with multimedia enhancement and discussed during the lectures. The student assesses the usefulness and functioning of the existing engineering and technical solutions as well as research and measurement methods in the chemical industry from the point of view of physicochemistry (K_BCh_U08).

Chemistry:

Written exam in the field of general physical chemistry covering practical aspect of the subject in everyday life (K_W03, K_W04). The student solves problems in writing tests or oral answers in the field of general physical chemistry (K_U01). Assessment of the Student's explanation of the course of chemical processes and experiments, assessment of the correctness of the analysis of results, drawing conclusions from the multimedia experiments (K_U08, K_U09). Method of verifying the acquisition of social competences: Assessment of the Student's ability to solve scientific and research problems based on work (K_K06). The student identifies the level of their knowledge and skills as well as the need for updating knowledge, continuous professional training, and personal development to present understandable presentation of physicochemical knowledge to the public (K_K07).

Environmental Protection:

Written exam in the field of general physical chemistry with practical aspects regarding the surrounding environment. During the lectures, the student solves problems in writing test or oral (oral answers) in the field of physical chemistry (K_OŚI_W01, K_OŚI_W04). The method of verifying the acquisition of skills: Assessment of the student's involvement in discussions on the issues related to this subject. Assessment of the Student's explanation of the course of chemical experiments, assessment of the correctness of the analysis of the results, drawing conclusions from the experiments presented with the assistance of multimedia and discussed during lectures (K_OŚI_U06, K_OŚI_U08). The student correctly assesses the usefulness and functioning of the existing solutions as well as research and measurement methods in the chemical industry. The method of verifying the acquisition of social competences: Assessment of the student's ability to solve scientific and research problems based on individual and teamwork (K_OŚI_K05, K_OŚI_K06).

Required courses and introductory requirements
A. Formal requirements

lack

B. Prerequisites

completed course in general chemistry

Aims of education

familiarize students with the main aspects of physical chemistry and its practical aspects in everyday life;
 familiarize students with the basic principles of chemical thermodynamics and kinetics;
 presenting the basis of occurrence of chemical transformations in nature;
 familiarize students with physicochemical methods of analysis;
 familiarizing students with selected issues in physical chemistry and their application to the description of biological processes

Course contents

Gas laws; Kinetic theory of gases; Liquids; Solids (crystalline structures); Phase and component; Single component systems, Phase diagrams; Two component systems, Raoult's law, Ideal and non-ideal solutions; Zeotropic and azeotropic mixtures; Fractional distillation; Colligative properties of solutions (boiling point elevation, freezing point depression; osmotic pressure); Reaction enthalpies and calorimetry; Hess law, The Born-Haber cycle; Rate law; collision theory; Factors affecting reaction rate; Chemical kinetics; Chromatographic processes; Principles of mass spectrometry and ¹H NMR spectroscopy; Principles of fluorescence spectroscopy and its uses.
 Concepts of physical chemistry in biochemistry: the laws of thermodynamics, thermodynamic state functions, thermodynamic criterion of spontaneous changes, energy transfer through living systems, equilibrium constants, thermodynamics of ion and electron transport (redox reactions in biological cells), physicochemical description of the following processes: aerobic and anaerobic respiration, fermentation, neural signaling and photosynthesis.

Bibliography of literature

Literature required to pass the course
 Peter Atkins and Julio de Paula, "Elements of Physical Chemistry", 7-th Ed., Oxford University Press, 2016, ISBN: 9780198727873.
 Peter Atkins, Julio de Paula, "Physical Chemistry for the Life Sciences", Second Edition, Oxford University Press. ISBN: 9780199564286.
 Extracurricular readings
 Eldra P. Solomon, Linda R. Berg, and Diana W. Martin, "Biology", Ninth Edition, Brooks/Cole, ISBN 9780538741255
 Peter Bolgar, Haydn Lloyd, Aimee North, Vladimiaras Oleinikovas, Stephane Smith, James Keeler, "Student Solutions Manual to Accompany Atkins' Physical Chemistry", 11-th Ed., Oxford University Press 2018, UK.
 ISBN: 978-0-198807773.
 Materials in pdf provided by the lecturers.

The learning outcomes (for the field of study and specialization)
Knowledge

<p>Chemical Business:</p> <p>K_BCh_W02: enumerates laws and theories in chemistry, physics and mathematics necessary to formulate and solve simple engineering tasks.</p> <p>K_BCh_W04: describes the role of experiment and computer simulation in the design process of engineering issues.</p> <p>K_BCh_U01: on the basis of the acquired knowledge, identifies, analyses and solves engineering tasks and problems in broadly understood chemistry.</p> <p>K_BCh_U08: uses the chemical nomenclature and engineering terminology properly.</p> <p>K_BCh_K01: identifies the level of her/his own knowledge and skills as well as the need to update engineering knowledge, continuous professional training and personal development.</p> <p>Chemistry:</p> <p>K_W03: explains at an advanced level the relationship between the structure of matter and its observed properties.</p> <p>K_W04: characterises the methods of chemical compound analysis.</p> <p>K_U01: identifies, analyses and solves problems in the field of broadly understood chemistry on the basis of the acquired knowledge.</p> <p>K_U08: presents in an understandable way the facts about chemistry using a scientific language typical of chemical sciences.</p> <p>K_U09: is able to learn independently.</p> <p>K_K06: raises her/his professional and personal competences by using information provided in various sources.</p> <p>K_K07: appreciates the need for understandable presentation of selected chemical issues to the public.</p> <p>Environmental Protection:</p> <p>K_OŚI_W01: describes in an advanced level physical, chemical and biological phenomena occurring in nature as well as geological, geomorphological and climatic conditions of the functioning of nature.</p> <p>K_OŚI_W04: explains at an advanced level the meaning and indispensability of empirical data in the description and interpretation of natural phenomena and processes (occurring in the environment).</p> <p>K_OŚI_U06: uses available sources of information and understands literature in the field of environmental protection, chemistry, and natural sciences.</p> <p>K_OŚI_U08: correctly concludes based on the available data from various sources.</p> <p>K_OŚI_K05: identifies the level of her/his knowledge and skills, demonstrates the need to update knowledge about the environment and its protection, demonstrates the need for continuous professional training and personal development.</p>	<p>Students know main states of matter and its physicochemical properties; understand physical properties of chemical substances and systems; understand gas laws; understand main physicochemical terms: phase and component, mixtures, know methods of purification and isolation of compounds; ideal/nonideal solutions; colligative properties of solutions; know concepts of enthalpy and Bohr-Haber cycle; Know Hess's law; know principles of chemical thermodynamics, know principles of chemical kinetics: collision theory and rate law, factors affecting reaction rate;; know the term kinetic constants; know physicochemical methods of analysis; give example of operation of thermodynamics and kinetics laws in everyday life. Students know the first and second laws of thermodynamics, understand the thermodynamic concept of spontaneous processes, understand the energy dynamics of a reaction at equilibrium and the dynamics of a reaction not at equilibrium, understand the role of the redox reactions in aerobic and anaerobic respiration, fermentation, and photosynthesis, understand passive and active transport of ions across biological membranes involved in neural signaling.</p> <p>Skills</p> <p>Students: present in writing and speech correct chemical argumentation; present and explain physicochemical phenomena and processes in laboratory and in environment - propose methods for isolation and analysis of chemical compounds; interpret and analyse information connected with chemistry presented as text, tables, plots, schemes, figures; formulate descriptions of different physicochemical phenomena and processes; describe them with use of own words and figures/schemes; explain similarities and differences in physicochemical properties of chemical substances in various environments; notice differences in chemical processes conducted at various conditions; write kinetic equations and calculate kinetic constants basing on experimental data; calculate enthalpies and entropies of chemical processes and provide information about their feasibility; explain phenomena observed in everyday life in the context of physicochemical laws; interpret information, formulates conclusions and explain opinions. Students present the implications of thermodynamic laws as they relate to organisms, explain how changes in free energy in a reaction are related to changes in entropy and enthalpy, present and explain phenomena and processes in living organisms in the physicochemical context, explain how do ions cross cell membranes and how does this transport affect important biological processes, such as ATP synthesis and neuronal activity.</p> <p>Social competence</p> <p>Students: understand need for learning, inspire other for learning; cooperate in group, taking different roles; exhibit creativity in determination of priorities necessary for realization of different tasks; understand social aspects of practical use of knowledge and abilities as well as connected with them responsibility; present care and responsibility for our environment resulting from physicochemical knowledge.</p>
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