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		
Faculty of Chemistry	Chemical Business	type	first tier studies (BA)
		form	full-time
		specialty	all
		specialization	all
Faculty of Chemistry	Chemistry	type	first tier studies (BA)
		form	full-time
		specialty	all
		specialization	all
Faculty of Chemistry	Environmental Protection	type	first tier studies (BA)
		form	full-time
		specialty	all
		specialization	all

Teaching staff

dr hab. Karol Krzymiński, profesor uczelni; dr hab. Piotr Storoniak, profesor uczelni

Forms of classes, the realization and number of hours

Forms of classes

Lecture

The realization of activities

classroom instruction

Number of hours

Lecture: 30 hours

ECTS credits

4
classes - 30 h
tutorial classes - 30 h
student's own work - 40 h
TOTAL: 100 h - 4 ECTS

The academic cycle

2024/2025 summer semester

Type of course

an elective course

Language of instruction

english

Teaching methods

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.

Form and method of assessment and basic criteria for eveluation or examination requirements

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

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 psychical 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)

Chemical Business:
K_BCh_W02: enumerates laws and theories in chemistry, physics and mathematics necessary to formulate and solve simple engineering tasks.
K_BCh_W04: describes the role of experiment and computer simulation in the design process of engineering issues.
K_BCh_U01: on the basis of the acquired knowledge, identifies, analyses and solves engineering tasks and problems in broadly understood chemistry.
K_BCh_U08: uses the chemical nomenclature and engineering terminology properly.
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.

Chemistry:
K_W03: explains at an advanced level the relationship between the structure of matter and its observed properties.
K_W04: characterises the methods of chemical compound analysis.

K_U01: identifies, analyses and solves problems in the field

Knowledge

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.

Skills

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

of broadly understood chemistry on the basis of the acquired knowledge.
K_U08: presents in an understandable way the facts about chemistry using a scientific language typical of chemical sciences.
K_U09: is able to learn independently.
K_K06: raises her/his professional and personal competences by using information provided in various sources.
K_K07: appreciates the need for understandable presentation of selected chemical issues to the public.

Environmental Protection:
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.
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).
K_OŚI_U06: uses available sources of information and understands literature in the field of environmental protection, chemistry, and natural sciences.
K_OŚI_U08: correctly concludes based on the available data from various sources.
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.

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 physiochemical 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.

Social competence

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.

Contact

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