GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00048765		
Field of study	Green Technologies		
Date of commencement of studies	October 2020	Academic year of realisation of subject	2021/2022
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	2	Language of instruction	English
Semester of study	3	ECTS credits	7.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Physical Chemistry -> Faculty of Chemistry		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Maciej Śmiechowski	
	Teachers	dr hab. inż. Maciej Śmiechowski dr inż. Łukasz Nierzwicki	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	15.0	45.0	0.0	0.0	90

E-learning hours included: 0.0

Adresy na platformie eNauczanie:
Physical Chemistry for Green Technologies 2021/22 - Moodle ID: 17606
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=17606

Additional information:
Distant classes include complete lectures, tutorials (problem solving) and introductory tests for the lab.

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	90	10.0	75.0	175

Subject objectives

The aim of the subject is to familarize the student with fundamental physico-chemical laws in chemical thermodynamics, phase equilibria and chemical equilibria together with ability of solving relevant text problems involving calculations, as well as teachnig him/her effective and safe carrying out simple experiments/measurements of physico-chemical quantities and proper presentation and interpretation of their results.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U03] is able to use information and communication technologies relevant to the common tasks of engineering, is able to use known methods and mathematical-physical models to describe and explain phenomena and chemical processes	Student is able to use known methods and mathematical-physical models to describe and explain phenomena and chemical processes	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment
[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 has basic knowledge of physical chemistry, including the knowledge necessary to describe and understand the phenomena and chemical processes occurring in the environment; measurements and determination of the parameters of these processes	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge

Subject contents	LECTURES Chemical thermodynamics: Termochemistry, Hess law and kirchoff's equation. State functions. First principle of thermodynamics. Thermodynamic cycles, Second principle, Gibbs free anergy and Helmholtz free energy. Third principle. Criteria of spontaneity and equilibrium of reactions. Open systems, partial molar quantities, chemical potential. Chemical equilibrium. Standard molar Gibbs free energy and reaction quotient. Equilibrium constants. Le Chatelier principle and Van't Hoff isobar. Gibbs-Helholtz equation. General conditions of phase equilibria. Clausius-Clapeyron equation. Gibbs rule of phases. Gibbs-Duhem equation. Selected equilibria in one-, two, and three-component systems (Gibbs triangle) – interpretation of phase diagrams. Simple and fractional distillation. Nernst law of pertition. Solutions: Colligative properties. Thermodynamic characteristics of the perfect and perfectly diluted solutions. Thermodynamic definition of activity and activity coefficients. Excess functions. TUTORIALS: Calculations of heats of reaction at constant V or P. Calculations of ΔS and ΔG of reaction. Relation of ΔG^0 with equlibrium constantsi. Calculations of chemical equilibria in gaseous phase, equilibrium compostions and sissociation (reaction) degree. Calculations in phase equilibria in one-component systems. Calculation of composition of phases in gas-liquid systems, compositions of distillates and residuals. Calculations related to colligative properties.. LABORATORY Performing 6 experiments from the list: 1. Vapor-liquid equilibrium of pure liquids. 2. Vapor-liquid equilibrium for a two component systems. 3. Cryometry - Measurements of freezing point depression. 4. Calorimetry: a) measuring specific heat of liquids; b) measuring heat of acid-base neutralization.. 5. Heat of dissolution 6. Determination of physicochemical constants of liquids.
Prerequisites and co-requisites	completed courses in mathematics, physics, inorganic chemistry and computer science

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Lab - written/oral tests	50.0%	16.0%
Lab - performance and reports	100.0%	16.0%
2 written tests	50.0%	28.0%
written/oral exam	50.0%	40.0%

Recommended reading

Basic literature	1. P. W. Atkins, J.A.Beran, General Chemistry, Oxford University Press, any edition above 2nd. 2. P. W. Atkins, Physical Chemistry, Oxford University Press, any edition above 5th. 3. W.Chrzanowski, lecture notes, lab manuals and text problems published in the web pages of the Department of Physical Chemistry
Supplementary literature	1. P. W. Atkins, Przewodnik po chemii fizycznej, PWN 1997. 2. K. Pigoń i Z. Ruziewicz, Chemia fizyczna, PWN 2006. 3. H. Buchowski i W. Ufnalski, Podstawy termodynamiki (poz. 1-6 z serii Wykłady z chemii fizycznej, WNT, Warszawa) 4. H. Buchowski i W. Ufnalski, Fizykochemia gazów i cieczy 5. H. Buchowski i W. Ufnalski, Gazy, ciecze i płyny 6. H. Buchowski i W. Ufnalski, Roztwory 7. W. Ufnalski, Równowagi chemiczne 8. H. Buchowski, Elementy termodynamiki statystycznej 9. W Libuś, Chemia Fizyczna, część I, PG, Gdańsk 1970. 10. M. Pilarczyk, Zadania z chemii fizycznej, PG, Gdańsk 1996. 11. I Uruska, Zbiór zadań testowych z chemii fizycznej, PG, Gdańśk 1997
eResources addresses	Physical Chemistry for Green Technologies 2021/22 - Moodle ID: 17606 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=17606

Example issues/ example questions/ tasks being completed	Published in web pages of the Department of Physical Chemistry at afore given link
Work placement	Not applicable