



Subject card

Subject name and code	Physical chemistry, PG_00057673						
Field of study	Green Technologies						
Date of commencement of studies	October 2022		Academic year of realisation of subject		2023/2024		
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		Polish		
Semester of study	3		ECTS credits		8.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Department Of Physical Chemistry -> Faculty Of Chemistry -> Wydziały Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Adam Kloskowski				
	Teachers		dr hab. inż. Dorota Warmińska				
			dr hab. inż. Adam Kloskowski				
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						
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		15.0		95.0	200
Subject objectives	The aim of the subject is to familiarize 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 understands mathematical formulae and can express verbally their meaning. Student can also formulate problems verbally with precision permitting to write a suitable equation. Student can analyse simple physicochemical problems and construct suitable algorithms to solve them.		[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools		
	[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 knows fundamental concepts in physical chemistry, is aware of their mutual relations and can explain these relations.		[SW1] Assessment of factual knowledge		

Subject contents	<p>LECTURES</p> <p>Chemical thermodynamics: Thermochemistry, Hess law and kirchoff's equation. State functions. First principle of thermodynamics. Thermodynamic cycles, Second principle, Gibbs free energy 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-Helmholtz equation. General conditions of phase equilibria. Clausius-Clapeyron equation. Gibbs rule of phases. Gibbs-Duhem equation. Selected equilibria in one-, twocomponent systems – interpretation of phase diagrams. Simple and fractional distillation. Nernst law of partition. Solutions: Colligative properties.</p> <p>TUTORIALS:</p> <p>Calculations of heats of reaction at constant V or P. Calculations of ΔS and ΔG of reaction. Relation of ΔG^0 with equilibrium constants. Calculations of chemical equilibria in gaseous phase, equilibrium compositions 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..</p> <p>LABORATORY</p> <p>Performing 6 experiments from the list:</p> <ol style="list-style-type: none">1. Calorimetry.2. Determination of heat of dissolution on the basis of dependence of solubility vs.temperature.3. Measuring of physicochemical constats of liquids.4. Measurering vapor pressures of liquids.5. Determination of a liquid-vapour phase diagram in a two-component system.6. Cryometry.		
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
	written/oral exam	50.0%	40.0%
	2 written tests	50.0%	28.0%
	Lab - written/oral tests	50.0%	16.0%
	Lab - performance and reports	100.0%	16.0%
Recommended reading	Basic literature	<ol style="list-style-type: none">1. K. Pigoń i Z. Ruziewicz, Chemia fizyczna, PWN 2006.2. P. W. Atkins, Chemia fizyczna, PWN 2001.3. H. Strzelecki, W.Grzybkowski (red.), Chemia fizyczna, ćwiczenia laboratoryjne, PG, Gdańsk 2004.4. M. Pilarczyk, Zadania z chemii fizycznej, PG, Gdańsk 1996.	
	Supplementary literature	<ol style="list-style-type: none">1. H. Buchowski i W. Ufnalski, Podstawy termodynamiki (poz. 1-6 z serii Wykłady z chemii fizycznej, WNT, Warszawa)2. W Libuś, Chemia Fizyczna, część I, PG, Gdańsk 1970.3. W. Grzybkowski, Chemia fizyczna w przykładach, PG, Gdańsk 2014	
	eResources addresses	Adresy na platformie eNauczanie: Chemia Fizyczna TCH 2023/24 - Moodle ID: 31324 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=31324 Chemia Fizyczna dla studentów Zielonych Technologii_2023/2024- ćwiczenia rachunkowe i laboratorium - Moodle ID: 33407 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=33407	
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none">1. Derive the equation linking the first and second laws of thermodynamics.2. Draw the dependence of the heat capacity of an ideal diatomic gas under constant pressure on temperature.3. Why is the melting curve of the water negative?4. Define the pressure equilibrium constant for a specific chemical reaction, then discuss the influence of temperature and pressure on the reaction yield.		
Work placement	Not applicable		

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