GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Physical chemistry, PG_00060852						
Field of study	Chemical Technology						
Date of commencement of studies	October 2024		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	2		Language of instruction	Polish			
Semester of study	3		ECTS credits	6.0			
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						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	30.0	0.0	0.0	75
	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	75		10.0	95.0		180
Subject objectives	The aim of the subject is to familarize the student with fundamental physico-chemical laws in chemicalthermodynamics, phase equilibria and chemical equilibria together with ability of solving relevant textproblems involving calculations, as well as teachnig him/her effective and safe carrying out simpleexperiments/ measurements of physico-chemical quantities and proper presentation and interpretation oftheir results.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W02] has knowledge of inorganic, organic, physical and analytical chemistry useful for obtaining selected groups of compounds, determining their physical and chemical properties allowing for their quantitative and qualitative analysis, making measurements and determining the parameters of chemical reactions, phenomena and processes occurring in chemical technology	The student has basic knowledge in in the field of physical chemistry, incl knowledge necessary to describe i understanding phenomena and processes chemicals found in environmental protection technologies and measurement and determination parameters of these processes. Effectively uses the concepts of scope of the subject, see there interconnections that can explain.	[SW1] Assessment of factual knowledge
[K6_U11] individually plans and implements his/her own learning	The student can do it independently plan a way and methodology of acquiring knowledge from the field of physical chemistry, which is necessary to complete tasks within the laboratory and accounting exercises.	[SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information
[K6_U02] is able to operate typical laboratory apparatus and conduct analyses related to materials testing	The student is able to operate laboratory equipment and measurement. He can plan and carry out measurements regarding the properties of materials in terms of basics physicochemical parameters.	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment
[K6_U03] is able to apply knowledge of inorganic, organic, physical and analytical chemistry and identify appropriate sources of information to design and synthesize simple chemical compounds, carry out basic physicochemical and analytical measurements	The student is able to prepare appropriate charts and use mathematical analysis for practical interpretation curve parameters. Applies linear regression techniques for processing the results. Student interprets correctly statistical measurement results. The student is able to carry out appropriate calculations.	[SU2] Assessment of ability to analyse information

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-, twocomponent systems – interpretation of phase diagrams. Simple and fractional distillation. Nernst law of pertition. Solutions: Colligative properties.
TUTORIALS:
Calculations of heats of reaction at constant V or P. Calculations of ΔS and ΔG of reaction. Relation of ΔG0 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. 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	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	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	
Example issues/ example questions/ tasks being completed	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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