



Subject card

Subject name and code	Physical chemistry, PG_00060852						
Field of study	Chemical Technology						
Date of commencement of studies	October 2023		Academic year of realisation of subject		2024/2025		
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						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Adam Kloskowski				
	Teachers		dr inż. Joanna Grabowska				
			dr hab. inż. Joanna Krakowiak				
			dr hab. inż. Maciej Śmiechowski				
			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	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 familiarize 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_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
	[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.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools
	[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.	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject
	[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 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
Subject contents	<p>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-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 pertition. Solutions: Colligative properties.</p> <p>TUTORIALS: Calculations of heats of reaction at constant V or P. Calculations of ΔS and ΔG of reaction. Relation of ΔG_0 with equilibrium constantsi. 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 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.</p>		
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 - performance and reports	100.0%	16.0%
	Lab - written/oral tests	50.0%	16.0%
	2 written tests	50.0%	28.0%
	written/oral exam	50.0%	40.0%

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. Grzybowski (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. Grzybowski, Chemia fizyczna w przykładach, PG, Gdańsk 2014
	eResources addresses	Adresy na platformie eNauczanie: Chemia Fizyczna TCH 2024/2025 - Moodle ID: 39546 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=39546
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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