GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Physical chemistry, PG_00069033						
Field of study	Chemical Technology						
Date of commencement of studies	October 2025		Academic year of realisation of subject	2026/2027			
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	5.0			
Learning profile	general academic profile		Assessment form	exam			
Conducting unit	Department of Physical Chemistry -> Faculty of Chemistry -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. inż. Adam Kloskowski				
	Teachers						

Lesson types	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	5.0	45.0	125

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] Possesses the chemical knowledge necessary to synthesize, analyze and evaluate the properties of compounds and processes used in chemical technology.	The student has basic knowledge of physical chemistry, including the knowledge necessary to describe and understand chemical phenomena and processes occurring in environmental protection technologies, as well as to measure and determine the parameters of these processes. They are able to efficiently use concepts within the scope of the subject, understand their interconnections, and can explain them.	[SW1] Assessment of factual knowledge
[K6_U03] Uses chemical knowledge to design compounds, perform physicochemical and analytical measurements, and obtain appropriate sources of information.	The student is able to prepare appropriate graphs and apply mathematical analysis for the practical interpretation of curve parameters. The student applies linear regression techniques to analyze results. The student correctly interprets measurement results statistically. The student is able to perform appropriate calculations	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
[K6_U02] Performs design calculations of technological processes, selects industrial equipment, operates laboratory equipment and conducts material analyses	The student is able to operate laboratory and measurement equipment. They are able to plan and conduct measurements of material properties in terms of basic physicochemical parameters.	[SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject

Subject contents

Course content – lecture
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.

Course content – exercises
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..

Course content – laboratory
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
2 written tests	50.0%	28.0%
written/oral exam	50.0%	40.0%
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.
Practical activites within the subject	Not applicable

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