GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Physical chemistry , PG_00048531		
Field of study	Chemical Technology		
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	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 hab. inż. Adam Kloskowski dr inż. Anna Kuffel dr hab. inż. Joanna Krakowiak	

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						
	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	75	5.0	70.0	150

Subject objectives	The aim of the subject is to familarize the student with fundamental physico-chemical laws in chemical thermodynamics, chemical equilibria and phase 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 results

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_U02	The student is able to operate the laboratory and measuring equipment. Can plan and carry out measurements of the properties of materials in terms of basic physicochemical parameters.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools
K6_W02	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. Student knows fundamental concepts in physical chemistry, is aware of their mutual relations and can explain these relations.	[SW1] Assessment of factual knowledge
K6_U03	Student can prepare suitable graphs/plots and applies mathematical analysis for practical interpretation of these plots. Student uses linear regression techniques for preparing the graphs and properly interprets the results of his/her measurements. Student can perform relevant calculations	[SU2] Assessment of ability to analyse information
K6_U11	The student is able to independently plan the way and methodology of acquiring knowledge in the field of physical chemistry, which is necessary for the implementation of laboratory tasks and accounting exercises.	[SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information

Subject contents

LECTURES

Chemicalthermodynamics: 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 S and G of reaction. Relation of G^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 5 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. Detrrmination of phase diagrams of condensed phase using cooling curves
7. Cryometry

Prerequisites and co-requisites

completed courses in mathematics, physics and inorganic chemistry

<table>
<tr><td>Assessment methods and criteria</td><td colspan="2"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>lab - oral test</td><td>50.0%</td><td>12.5%</td></tr>
<tr><td>Lab - performance and reports</td><td>100.0%</td><td>12.5%</td></tr>
<tr><td>3 written tests</td><td>50.0%</td><td>25.0%</td></tr>
<tr><td>written exam</td><td>50.0%</td><td>50.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>1. P. W. Atkins, Physical Chemsitry, Oxford University Press, any edition above 5th.
2. I Uruska (red.), Zbiór zadań z chemii fizycznej, PG, Gdańsk 1997.
3. H. Strzelecki, W.Grzybkowski (red.), Chemia fizyczna, ćwiczenia laboratoryjne, PG, Gdańsk 2004.
4. W.Chrzanowski, notatki wykładowe oraz zadania z chemii fizycznej publikowane w sieci na stronach katedry</td></tr>
<tr><td>Supplementary literature</td><td>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.</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:
Chemia Fizyczna TCH 2023/24 - Moodle ID: 31324
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=31324</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=31324</td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
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