GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Physical chemistry, PG_00057673		
Field of study	Green Technologies		
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	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. Dorota Warmińska	
	Teachers	dr hab. inż. Dorota Warmińska	

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

eNauczanie source addresses:

Moodle ID: 983 Chemia fizyczna dla studentów kierunku Zielone Technologie - semestr zimowy 2025/2026
https://enauczanie.pg.edu.pl/2025/course/view.php?id=983

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 familarize 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_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
[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.	[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment

<table>
<tr><td>Subject contents</td><td>LECTURES
Chemical thermodynamics: State functions. First principleof thermodynamics. Thermodynamic cycles, Termochemistry, Hess law and kirchoff's equation.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:
Thermodynamics of ideal gas transformations. Heat of reaction under conditions of constant V and P. Calculations of ΔS during mixing or temperature changes. Phase equilibria in single-component systems. Calculations of vapor compositions in equilibrium with an ideal solution, distillate compositions, and bottomed liquid compositions. Chemical equilibrium in the gas phase: calculations of equilibrium compositions and degree of conversion. Calculations related to cryoscopic, ebullioscopic, and other 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. Determination of the complex composition by spectrophotometric method.
4. Measurering vapor pressures of liquids.
5. Determination of a liquid-vapour phase diagram in a two-component system.
6. Cryometry.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>completed courses in mathematics, physics, inorganic chemistry and computer science</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>written/oral exam</td><td>50.0%</td><td>40.0%</td></tr>
<tr><td>2 written tests</td><td>50.0%</td><td>28.0%</td></tr>
<tr><td>Lab - written/oral tests</td><td>50.0%</td><td>16.0%</td></tr>
<tr><td>Lab - performance and reports</td><td>100.0%</td><td>16.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>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.</td></tr>
<tr><td>Supplementary literature</td><td>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</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>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.</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
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