GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Physical chemistry, PG_00057679		
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	4	ECTS credits	7.0
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	dr hab. inż. Dorota Warmińska	
	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

eNauczanie source address: https://enauczanie.pg.edu.pl/2025/course/view.php?id=5400

Moodle ID: 5400 Chemia fizyczna dla studentów Zielonych Technologii semestr letni 2025/2026 https://enauczanie.pg.edu.pl/2025/course/view.php?id=5400

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	15.0	85.0	175

Subject objectives

The aim of the subject is familiarizing the students with basic concepts in electrochemistry, chemical kinetics and surface phenomena.

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 ecological and social consequences of practical implementations of the phenomena under study. Student efficiently uses basic concepts involved in the subject, is concious of their mutual relations and is capable to 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 can analyse basic problems in the field and construct solving algorithms. Student is oriented in basic measuring techniques in physical chemistry and is familiar with relevant instrumentation. Student understands physico-chemical formulae and expressed verbally their meaning. Student is capable of expressing assorted relations verbally with precision allowing for writing a suitable equation.	[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>Course content – lecture
Interfacial phenomena. Surface tension. Surfactants. Adsorption on liquid-gas interface. Gibbs adsorption isotherm. Characterization of colloidal particles. Structure of colloidal particle. Electrokinetic phenomena. Coalescence and coagulationAdsorption on solid-gas interface. Langmuir isotherm. BET isotherm. Thermodynamic description.

Electrolyte solution. Theory of strong electrolytes. Activity coefficients. Electrical conductivity. Electrode-solution interface. Interfacial potentials. Electrodes and galvanic cells. Thermodynamics of galvanic cells. Electromotive force measurements. Practical aspects of potentiometry. The determination of pH. Standard reduction potentials. The electrochemical series. Electrode polarization. Electrolysis. Galvanic sources of energy. Corrosion.

Chemical kinetics. Reaction rates. Rate laws and rate constants. Elementary reactions. Reaction mechanisms. Homogeneous and heterogeneous catalysis. Enzymatic processes. Chain reactions. Explosion.
Course content – exercises
Basic concepts of electrolysis, electrode reactions occurring in an electrolyzer. Faraday's laws of electrolysis. Ion transference numbers Hittorf's method. Conductivity of electrolyte solutions. Conductivity, molar conductivity, equivalent conductivity, the relationship between molar conductivity and the transference number of a given ion. Galvanic cells. Cell notation. Electrode reactions. Electrode electromotive force of a cell. Nernst's formulas for half-cell potentials. Kinetics of simple reactions. Kinetic equations for zero-, first-, and second-order reactions. Rate constant, reaction rate, degree of conversion, reaction half-time. Determining the order of a reaction. Kinetics of complex reactions. Reversible and parallel reactions. Surface tension. Capillary rise, droplet size. Surface excess. Dependence of surface tension on solute concentration. Szyszkowski's equation. Surface pressure of a solution. Maximum surface area, seating area and degree of coverage.
Course content – laboratory
Kinetics of aniline iodination, kinetics of sucrose inversion, determination of ion transference numbers, determination of activity coefficients, adsorption in a solid-liquid system, determination of thermodynamic parameters of the reaction taking place in the cell, conductometry</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Knowledge of mathematics, physics and inorganic chemistry at BSc level.</td></tr>
<tr><td>Assessment methods and criteria</td><td>
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<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>2 written tests in calculations</td><td>50.0%</td><td>30.0%</td></tr>
<tr><td>performing 5 experiments and delivering the reports</td><td>100.0%</td><td>30.0%</td></tr>
<tr><td>written exam</td><td>50.0%</td><td>40.0%</td></tr>
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<tr><td>Recommended reading</td><td>
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<tr><td>Basic literature</td><td>1. Chemia fizyczna. P.W.Atkins, PWN
2. Chemia fizyczna.1.Podstawy fenemenologiczne. K.Pigoń i Z.Ruziewicz, PWN
3. Chemia fizyczna. Ćwiczenia laboratoryjne. Red.: H.Strzelecki i W.Grzybkowski, Wydawnictwo PG</td></tr>
<tr><td>Supplementary literature</td><td>1. Wykłady z chemii fizycznej (praca zbiorowa). Wydawnictwo NT
2. Chemia fizyczna. 2.Fizykochemia molekularna. K.Pigoń i Z.Ruziewicz, PWN
3.Eksperymentalna chemia fizyczna. Red.: H.Strzelecki, Wydawnictwo PG
4. Zadania z chemii fizycznej, Red. I.Uruska, Wydawnictwo PG
5. Chemia fizyczna. Zbiór zadań z rozwiązaniami. P.W.Atkins i inni, PWN</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. Description of the phase diagram for a simple eutectic system.

2.Description of the measurement of electrical conductivity.

3. Hitthorf method for ion tranfer numbers.</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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