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 2026	Academic year of realisation of subject	2027/2028
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

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.	knows ecological and social consequences of practical implementations of the phenomena under study; 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	is able to analyse basic problems in the field and construct solving algorithms; is oriented in basic measuring techniques in physical chemistry and is familiar with relevant instrumentation; understands physico-chemical formulae and expressed verbally their meaning; is capable of expressing assorted relations verbally with precision allowing for writing a suitable equation.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools

Subject contents

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

Conductivity of electrolyte solutions: conductivity, molar conductivity and equivalent conductivity; relationship between molar conductivity and ionic transport numbers; additivity of molar conductivity. Galvanic cells: cell notation, electrode reactions, electromotive force of a cell, the Nernst equation and half-cell potentials. Electrolysis: electrode processes, ionic transport numbers and their determination using the Hittorf method. Kinetics of simple irreversible reactions: rate equations for zero-, first- and second-order reactions; reaction rate, rate constant, extent of reaction and half-life; methods for determining reaction order. Kinetics of complex reactions: reversible and parallel reactions. Surface phenomena: capillary rise, drop size, surface excess, dependence of surface tension on solute concentration, the Szyszkowski equation and surface pressure of solutions. Maximum surface excess, area occupied per molecule in the adsorption layer and degree of surface coverage.

Course content – laboratory

- Adsorption at the solid–liquid interface.
- Determination of ionic transport numbers.
- Conductometric titration.
- Determination of activity coefficients based on electromotive force (EMF) measurements.
- Kinetic study of the iodination of aniline.

Prerequisites and co-requisites

Knowledge of mathematics, physics and inorganic chemistry at BSc level.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Lecture: written exam	50.0%	40.0%
Laboratory: performing 5 experiments and delivering the reports	100.0%	30.0%
Exercises: 2 written tests in calculations	50.0%	30.0%

Recommended reading

Basic literature	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
Supplementary literature	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
eResources addresses	

Example issues/ example questions/ tasks being completed

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.

Practical activites within the subject

Not applicable

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