GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	PHYSICAL CHEMISTRY, PG_00064393						
Field of study	Chemistry						
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	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. Piotr Bruździak				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	15.0	45.0	15.0	0.0	105
	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	105		5.0	65.0	175	
Subject objectives	The aim of the course is to learn the basic issues related to absorption spectroscopy, electrochemistry, and surface and transport phenomena.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W02] classifies acquired information, assessing its usefulness in solving the posed problems concerning the synthesis and analysis of selected groups of compounds, determining their physical and chemical properties, making measurements and determining the parameters of chemical reactions and processes	The student has the knowledge necessary to correctly select appropriate measurement and calculation methods for determining physicochemical parameters and assessing their suitability.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
[K6_U02] determines the time required for the task, plans and organises the work of both the individual and the small team in such a way as to ensure that the task is completed within the set time limit	The student is able to plan and organize laboratory work in order to effectively perform physicochemical measurements within the set time.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
[K6_U04] creates detailed documentation of the results obtained from the experiments carried out individually or as part of a team, analysing and interpreting the results in the form of text documents, spreadsheets, graphs, technological diagrams, multimedia presentations using correct chemical nomenclature	The student is able to develop, analyze, and interpret experimental results using statistical methods and IT tools, preparing detailed documentation.	[SU1] Assessment of task fulfilment [SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools
[K6_K03] is aware of the importance of caring for the quality and diligence of the tasks performed, being responsible for their consequences	The student demonstrates care for measurement precision and reliability in reporting research results.	[SK1] Assessment of group work skills [SK2] Assessment of progress of work [SK3] Assessment of ability to organize work [SK5] Assessment of ability to solve problems that arise in practice

Subject contents	Course content – lecture Ionic equilibria in solutions: ion activity, electrolyte activity. Electrical conductivity of electrolyte solutions. Electrochemical cells and electrode processes. Basics of absorption spectroscopy (electronic and vibrational). Physicochemical properties of substances and basic surface and transport phenomena. Course content – exercises Electrical conductivity of electrolyte solutions Electrochemical cells and electrode processes Physicochemical properties of substances, basic surface phenomena, and transport phenomena Course content – laboratory Physicochemical constants of liquids Activity coefficients of hydrochloric acid Conductometric titration Kinetics of aniline iodination Spectrophotometric determination of transition metal complex composition Solid-liquid adsorption Course content – project Design of a capillary tensiometer Simple spectrophotometer verification of the Beer-Lambert law applicability range Chemometric analysis of spectroscopic data Ionic equilibria in weak acid solutions Determination of acetic acid pKa based on DFT calculations Crystal lattice enthalpy of NaBr
Prerequisites and co-requisites	Preceding subjects: mathematics, physics, and general chemistry. Knowledge of problems from physical chemistry, 3rd semester.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
short tests + seminar presentation	60.0%	20.0%
final exam	60.0%	50.0%
exercise - 2 written tests	60.0%	20.0%
tests + laboratory reports	60.0%	10.0%

Recommended reading	Basic literature	1. Chemia fizyczna, P. W. Atkins, PWN. 2. Chemia fizyczna, 1.Podstawy fenomenologiczne, K. Pigoń and Z. Ruziewicz, PWN. 3. Chemia fizyczna. Ćwiczenia laboratoryjne. Red. H. Strzelecki i W. Grzybkowski, Wydawnictwo PG.
	Supplementary literature	1. Elektrochemia, W. Libuś, PWN 2. Chemia fizyczna. Zbiór zadań z rozwiązaniami, P.W. Atkins, C.A. Trapp, M.P. Cady, C. Giunta, PWN. 3. Chemia fizyczna. Laboratorium fizykochemiczne, L. Komorowski, A. Olszowski, PWN. and a list of scientific papers forming the basis of the seminar project.
	eResources addresses	
Example issues/ example questions/ tasks being completed	LECTURE: 1. Show the relationship between the thermodynamics of the reaction taking place in the cell and its standard electromotive force. 2. Transport and surface phenomena - explain the cause of viscosity and its relationship with temperature. 3. Present the Beer-Lambert law, its application and limitations. EXERCISES: 1. Determine the value of the surface tension of the liquid based on the given experimental data. 2. Determine the EMF of the cell under standard conditions based on the attached thermodynamic data. LAB: 1. Thermodynamic parameters of the adsorption process. 2. Methods for determining activity coefficients. 3. Description of conductometric titration curves. PROJECT: 1. Ionic equilibria in solutions - simulations based on thermodynamic data. 2. Beer-Lambert law	
Practical activites within the subject	Not applicable	