University of Gdańsk

Subject card

Subject name and code	Physical chemistry, PG_00080719						
Field of study	Chemical Business						
Date of commencement of studies	October 2024		Academic year of realisation of subject		2025/2026		
Education level	undergraduate studies		Subject group		Obligatory subject group 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		2.0		
Learning profile	academic		Assessment form				
Conducting unit	Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. Janusz Rak				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	0.0	0.0	30
	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	30		5.0		15.0	50
Subject objectives	Acquainting students with the description of irreversible processes and the functioning of nature based on thermodynamics, with the phenomenological description of chemical changes over time based on chemical kinetics, with the description and applications of catalytic phenomena, and with the description and utilization of electrochemical processes. Acquiring the skills to understand and quantitatively describe physical transformations, chemical reactions, and to use physicochemical data in preparation for studying other subjects.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[BCHINŻ_W02] Enumerates basic laws and theories in chemistry, physics and mathematics necessary to formulate and solve simple engineering tasks.	Has general knowledge of the basic concepts, principles, and theories of physical chemistry."	[SW4] test/exam - oral or written
[BCHINŻ_U02] Uses basic methods, techniques and tools in formulating and solving engineering tasks in the field of chemistry.	Is capable of applying techniques, methods, and tools to conduct research in the field of physical chemistry.	[SU4] test/exam - oral or written
[BCHINŻ_K01] Identifies the level of her/his own knowledge and skills as well as the need to update engineering knowledge, continuous professional training and personal development.	Is aware of knowledge and skills, understands the need for continuous professional development and personal growth, self-assesses own competencies and improves skills, sets directions for own development and education.	[SK4] test/exam - oral or written
[BCHINŻ_U08] Uses the chemical nomenclature and engineering terminology properly.	Can properly use chemical nomenclature and engineering terminology in speech and writing.	[SU4] test/exam - oral or written
[BCHINŻ_U03] Plans, selects the appropriate research and measuring equipment and performs simple chemical experiments; analyses the results and draws conclusions based on them.	Can plan and conduct simple experimental studies or observations and analyze the results.	[SU4] test/exam - oral or written
[BCHINŻ_W03] Describes the techniques of higher mathematics and IT tools necessary to describe and model chemical phenomena and technological processes.	Understands and can explain patterns, phenomena, and processes using the language of mathematics, particularly able to independently reproduce basic laws and theorems.	[SW4] test/exam - oral or written
[BCHINŻ_W07] Describes the construction and operating principles of basic scientific, technological and control-measuring apparatus.	Identifies scientific research equipment encountered during studies and explains the principles of its operation.	[SW4] test/exam - oral or written

Subject contents

Fundamentals of chemical thermodynamics of reversible processes: basic quantities and relationships between them, principles of thermodynamics. Phenomenological and molecular interpretation of energy and entropy. Thermodynamics: basic relationships, calculations. Thermodynamic criteria for equilibrium, equilibrium constant. Thermodynamics of the formation of ideal and real solutions. Physicochemical properties of gases, liquids, and solids. Phase equilibria: phase diagrams, physicochemical foundations of distillation, rectification, crystallization, and extraction processes. Chemical kinetics: elementary and complex processes, absolute reaction rate theory. Homogeneous and heterogeneous catalysis: mechanisms, technological and natural significance. Conductivity of electrolyte solutions. Dependence of conductivity on temperature, pressure, and type of solvent. Theory of strong electrolytes. Relaxation and electrophoretic effects - Debye-Hückel-Onsager theory. Conductivity of electrolytes in solvents with low dielectric constants. Electrochemical spontaneous and forced processes: cells, electrolysis.

Prerequisites and co-requisites

The necessity to complete courses in: general chemistry, basics of advanced mathematics, and fundamentals of physics.

Knowledge of general chemistry at the undergraduate level, familiarity with basic concepts and principles of mathematics and physics.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
egzam	51.0%	100.0%

Recommended reading

Basic literature	1. P. Atkins, J. De Paula, J. Keeler, Atkin's Physical Chemistry, Oxford University Press, 2022. 2. P. Atkins, Julio De Paula, Elements of Physical Chemistry, Oxford University Press, 2016. 3. P. Atkins, Physical Chemistry: A Very Short Introduction, Oxford University Press, 2014.
Supplementary literature	1. P. Atkins, The Laws of Thermodynamics: A Very Short Introduction, Oxford University Press, USA, 2010. 2. A. M. Steane,Thermodynamics: A Complete Undergraduate Course, Oxford University Press, 2016. 3. R. M. Rosenberg, I. M. Klotz,Chemical Thermodynamics: Basic Concepts and Methods, Wiley-Intrerscience, 2008. 4. C. H. Hamann, A. Hamnett, W. Vielstich, Electrochemistry, Wiley-VCH GmbH, 2007.
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	1. Work, heat and changes in internal energy and enthalpy in the isothermal, isochoric, isobaric and adiabatic transformations of ideal gases. 2. Derive the Claussius-Clapeyron law and show how the pressure of saturated vapor in equilibrium with the liquid should depend on temperature. 3. Using the theory of active collisions, explain the origin of steric, pre-exponential and exponential factors. 4. How does Lindemann's theory explain the second order of unimolecular reactions observed at low substrate pressures? 5. Compare Hittorf's method with the moving boundary method. Describe the advantages and disadvantages of each method. 6. Derive relationships between the electromotive force and its temperature coefficient and the thermodynamic functions of the reaction taking place in the cell.
Work placement	Not applicable

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