University of Gdańsk

Subject card

Subject name and code	Physico-chemical analytical methods, PG_00082037		
Field of study	Chemistry		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2026/2027
Education level	Bachelor's 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	3	Language of instruction	Polish Polish
Semester of study	5	ECTS credits	3.0
Learning profile	academic	Assessment form	exam
Conducting unit	Laboratory of Luminescence Research -> Department of Physical Chemistry -> Faculty of Chemistry -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Karol Krzymiński	
	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	40.0	75

Subject objectives

Familiarizing students with the issues included in the course content; Deepening and enriching physicochemical knowledge with practical aspects; Acquiring the ability to independently perform physicochemical measurements, processing and evaluating the obtained results. Familiarization with the methodology of modern physicochemical measurements. Understanding the phenomena of physicochemical processes and their relation to the environment; Selecting and assessing the acquired information; Developing self-education skills by acquiring and analyzing information from various sources.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[CHEML3_U05] Uses basic statistical methods and IT techniques to describe chemical processes and analyse experimental data.	- The student draws conclusions about the properties and behavior of the tested system based on physicochemical data; - can use experimental data to perform calculations related to the thermodynamics and kinetics of a chemical system.	[SU1] oral statement/conversation/ discussion [SU4] test/exam - oral or written
	[CHEML3_K05] Observes established procedures in laboratory work and is responsible for the safety of her/his and others' work.	- The student participates in dividing the exercise group into smaller teams; - Takes responsibility for the scope of duties performed and the results achieved and/or works individually. - Makes decisions related to the strategy for performing subsequent stages of laboratory work and optimally manages the time allocated for subsequent experimental tasks, takes responsibility for the results of his work in the context of groups. - Independently answers written problem questions. - Shares the obtained experimental result, providing information to other people	[SK1] oral statement/conversation/ discussion [SK4] test/exam - oral or written
	[CHEML3_W10] Enumerates and describes the basic aspects of the construction, operation and use of measuring apparatus and equipment used in experimental works in the field of chemistry and related sciences.	- The student selects a method for the given laboratory task during a discussion in the laboratory - Participates in the discussion when planning the experiment; - Recognizes the elements of modern equipment for physicochemical tests and provides their functions.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
	[CHEML3_U07] Prepares documented elaboration on a specific problem in the field of selected chemical and physical issues.	- The student prepares a written note containing the experimental results; - Prepares digital documentation and orders the results in a table.	[SU1] oral statement/conversation/ discussion [SU4] test/exam - oral or written
	[CHEML3_W04] Characterises the basic methods of chemical compound analysis.	- The student selects/proposes optimal methods for analyzing selected physicochemical parameters of the system.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
	[CHEML3_U03] Selects the appropriate equipment and laboratory apparatus for conducting uncomplicated chemical experiments.	- The student prepares a written note including the results of the experiment, - Creates digital documentation in the form of a photograph and collects the results in a table	[SU1] oral statement/conversation/ discussion [SU4] test/exam - oral or written
	[CHEML3_U02] Performs analyses using experimental methods and draws conclusions based on them.	- The student uses the obtained partial measurement result to plan the next experiment; - After recognizing an incorrect result, it performs corrective actions or repeats the procedure.	[SU1] oral statement/conversation/ discussion [SU4] test/exam - oral or written
	[CHEML3_W02] Describes the properties of elements and the most important chemical compounds, enumerates the methods of their preparation and methods of analysis.	The student answers the test and problem questions; - Applies theoretical laws and relationships in the context of performed tasks.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
Subject contents	Enthalpy of changes in the environment; Crystal lattice energy and solubility; Born-Haber cycle; Entropy, enthalpy and the surroundings; Thermodynamic analysis in practice; Kinetics in natural/industrial processes; Gibbs phase rule analysis for mixtures; Phase diagram analysis; Fractional distillation in industry; Refractometry; Applications of colligative properties of solutions.Applications of UV-Vis spectroscopy; Chromophores and auxochromes; batho- and hypsochromic shift. NMR spectroscopy: structure of the spectrometer, formation of spectra; Emission techniques: fluorescence (FL); Jabłoński's diagram; Kasha and Vavilov's law; Stokes shift; Determination of the equilibrium constant in the excited state; FL in quantitative analysis; Requirements and properties for FL probes; FRET processes; Chemiluminescence (CL) and bioluminescence (BL); Advantages of luminometric methods; CL measurements; FL and CL Quantum Efficiency, CL Markers and Indicators; Determination of parameters used in HPLC validation; Calibration charts in HPLC. MS spectrometry and mixed techniques; MS-MS type analyses; LC-MS and other combined techniques; Examples of applications of MS and LC-MS methods.		

Prerequisites and co-requisites	- Passing courses in the following subjects at the first-cycle (bachelor's) level: mathematics, physics, general chemistry, physical chemistry.- The student is able to use source texts, obtains, analyzes, evaluates and processes information from various sources. Acquires knowledge through research - observes, verifies, independently draws conclusions and generalizes.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Test exam with varying degrees of difficulty	51.0%	100.0%

Recommended reading

Basic literature	1. P.W. Atkins, Physical Chemistry, PWN Scientific Publishing House, Warsaw 2003.2. L. Sobczyk, A. Kisza, K. Gatner, A. Koll, Experimental physical chemistry, PWN Warszawa 1982.3. Electronic materials provided by the lecturer.
Supplementary literature	1. E. Więckowska-Bryłka, Experimental physical chemistry, SGGW Publishing House, Warsaw 2007.2. J. Demichowicz-Pigoniowa, Physicochemical calculations, PWN Warszawa, 1984.3. P. Suppan, Chemistry and light, PWN Warszawa 1998.
eResources addresses	

Example issues/ example questions/ tasks being completed	1. Indicate the optimal answer regarding the partition coefficient (P): 2. Under standard conditions, aqueous solutions of sulfuric acid are stable, while sulfuric acid (IV) decomposes slowly with the release of gaseous sulfur oxide (IV). Calculate the free energy change for the above processes using the given thermochemical data.3. Match the answers to the statements about the spontaneity of chemical processes Ho > 0, So < 0; Ho < 0, So < 0; Ho < 0, So > 0; Ho > 0, So > 0.4. For a certain reaction, 50% of the substrate reacted after 10 seconds and 75% - after 20 seconds. The rate constant of this reaction due to the disappearance of the substrate takes value ...
Work placement	Not applicable

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