University of Gdańsk

Subject card

Subject name and code	Physical chemistry, PG_00153746		
Field of study	Chemistry		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2025/2026
Education level	Bachelor's studies	Subject group	Optional subject group
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	English English
Semester of study	3	ECTS credits	4.0
Learning profile	academic	Assessment form	credit
Conducting unit	Faculty of Chemistry -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Piotr Storoniak	
	Teachers	Paula Pryba	

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	30.0	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	20.0	50.0	100

Subject objectives	The aim of the course is for the student to acquire the ability to understand and quantitatively describe physical changes and chemical reactions, to gain experience in using physicochemical data; skills in performing physicochemical measurements, describing the results of these measurements and their critical interpretation

Learning outcomes

Course outcome	Subject outcome	Method of verification
[CHEML3_U06] Uses basic application software packages to solve problems from the field of science.	- performs physicochemical calculations using spreadsheets	[SU3] text preparation/written work
[CHEML3_W01] Enumerates basic laws and theories in chemistry, physics, mathematics and biology.	- has general knowledge of basic concepts, principles and theories in the field of physical chemistry - can independently reconstruct the basic laws and theorems in the field of thermodynamics, statics, kinetics and electrochemistry	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
[CHEML3_W06] Chooses higher mathematics techniques to the extent necessary to understand and describe the physical processes important for understanding chemistry.	- understands and is able to explain the regularities of physicochemical phenomena and processes using the language of mathematics	[SW4] test/exam - oral or written [SW3] text preparation/written work
[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.	- identifies scientific and research equipment and explains the principles of its operation	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
[CHEML3_U04] Plans and performs simple chemical experiments and analyses the results obtained.	- can plan and perform simple experimental tests or observations and analyze the results - is able to analyze problems and find their solutions based on known laws and methods - draws conclusions from the conducted research and proves their correctness based on available literature data	[SU5] implementation of a problem task
[CHEML3_K05] Observes established procedures in laboratory work and is responsible for the safety of her/his and others' work.	- ensures safety when performing experiments, - complies with the arrangements made regarding the experiments carried out - can cooperate and work in a group, taking on various roles	[SK8] observation of student's independent or team work
[CHEML3_K01] Identifies the level of her/his own knowledge and skills and the need for continuous learning and personal development.	- performs planned experiments, - develops interest in physicochemical research issues	[SK1] oral statement/conversation/ discussion

Subject contents

- thermochemistry: principle of calorimetric measurements, heat capacity, bomb calorimeter;
- phase equilibria: liquid-vapor equilibrium diagrams for infinitely miscible two-component systems (isotherms and isobars); leverage rule; fractional distillation of zeotropic and azeotropic systems;
- behavior of the molecule in an electric field; determination of the refractive index; principle of operation of a dielectrometer, refractive index and its measurement;
- chemical kinetics: determination of activation energy, influence of the catalyst on the course of the reaction, influence of temperature on the reaction rate constant, control of the reaction temperature;
- basic types of physical adsorption isotherms (Langmuir, Freundlich, BET); specific surface area and its calculation; application of the adsorption phenomenon;
- methods of measuring SEM and determining the activity coefficient; pH coefficient and its potentiometric measurement, pH meters, glass, calomel, quinhydrone, antimony electrodes, electrode characteristics;
- spectroscopy: determination of the dissociation constant based on spectroscopic measurements; calculations based on the Lambert-Beer law; applications of spectroscopic measurements; principle of operation of a UV-VIS spectrophotometer

Prerequisites and co-requisites

Knowledge of general chemistry at the first-cycle level, knowledge of basic concepts and principles in mathematics and physics, ability to conduct chemical and physical experiments, knowledge of the principles of construction and operation of basic chemical equipment, ability to analyze experimental data, knowledge of basic principles of occupational health and safety in the laboratory chemical.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
report on the exercise performed	51.0%	80.0%
assessment of the student's own work	51.0%	20.0%

Recommended reading

Basic literature	1) materials provided by the instructor 2) Peter Atkins, Julio de Paula, and James Keeler, Atkins' Physical Chemistry, Twelfth Edition, Oxford University Press, 2022

	Supplementary literature	1) Richard Wilhelm Heinrich Abegg, Walter Georg Herz, Practical Chemistry: An Experimental Introduction To Laboratory Practice And Qualitative Analysis From A Physicochemical Standpoint, Ulan Press, 2012
	eResources addresses	
Example issues/ example questions/ tasks being completed	- thermochemistry: first and second law of thermodynamics - thermochemistry: measurement of reaction enthalpy - thermochemistry: practical application of Hess's law - thermochemistry: principles of calorimetric measurement - phase equilibria: Konovalov's second law - phase equilibria: determining the composition of vapor and liquid of two-component mixtures - phase equilibria: plotting a phase diagram boiling point vs. solution composition - chemical kinetics: determining the reaction rate constant - chemical kinetics: study of the influence of temperature on the reaction rate - chemical kinetics: determination of activation energy - chemical kinetics: order of kinetic equations - surface phenomena: determining the adsorption surface of coal - electrochemistry: types of electrodes with particular emphasis on ion-selective electrodes - electrochemistry: reactions taking place in cells, Nernst equation - spectrochemistry: measurements using a UV-Vis spectrophotometer	
Work placement	Not applicable	

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