University of Gdańsk

Subject card

Subject name and code	Graduate study lecture - Methods of physicochemical analysis of inorganic and hybrid compounds, PG_00117694		
Field of study	Chemistry		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2024/2025
Education level	Master's studies	Subject group	Obligatory subject group in the field of study Optional subject group
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	3.0
Learning profile	academic	Assessment form	credit
Conducting unit	Laboratory of Biological Inorganic Chemistry -> Department of General and Inorganic Chemistry -> Faculty of Chemistry -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Joanna Makowska	
	Teachers	dr hab. Joanna Makowska dr inż. Krzysztof Żamojć	

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	• familiarization with all issues mentioned in the lecture program content

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[CHEMMU2_W05] Has extended knowledge in the field of the specialisation studied.	Knows the methodology for determining the structure of chemical compounds and basic spectral methods (infrared spectroscopy, UV-VIS spectroscopy); knows the basic systems for classifying liquid chemical reaction environments; knows and understands the processes of acid-base interactions occurring in non-aqueous environments; understands the issues of hydrogen bonding and proton transfer equilibria in non-aqueous media; knows basic instrumental methods for examining equilibria in non-aqueous environments; knows theoretical methods enabling the study of the influence of pH value and the type of solvent on the conformation of model peptides, as well as methods for predicting the course of potentiometric titration curves and determining pKa constants for peptide systems; knows the correct nomenclature and chemical symbols used in thermal analysis and calorimetry; knows the techniques used in thermal analysis and calorimetry; knows the elements of chemistry of single-core complex compounds; understands the equilibrium formation of single-core complexes and knows the methodology for determining the stability constants of acid-base single-core complexes using spectrophotometric and potentiometric methods; knows selected kinetic methods for determining the mechanisms of a chemical reaction: flow methods - stopped-flow method, continuous-flow method, intermittent flow method - quenchedflow; knows the methodology of analyzing kinetic data obtained as a result of spectrophotometric measurements; knows the characteristics of hydrogen bonding and its occurrence (inorganic and organic compounds); knows measurement techniques enabling finding a hydrogen bond in a chemical compound (infrared spectroscopy, 1H-NMR, UV and UV-VIS spectroscopy, potentiometry, conductometry, computational methods, calorimetry, dielectric tests, diffraction tests); knows the division of amino acids according to the structure of the side chain and understands models for describing hydrophobic association.	[SW4] test/exam - oral or written

Course outcome	Subject outcome	Method of verification
[CHEMMU2_U02] Critically assesses the results of conducted, performed observations and theoretical calculations and discusses errors.	-Student is aware of the need to critically analyze one's own work, seeking explanations in professional literature sources; - Student develops the ability to think critically and assess the quality of information regarding the research context and evaluate the results, also based on the opinion of experts. -The student is critical in expressing opinions on the results obtained during research and is open to the opinions of co-discussants.	[SU2] presentation/project/paper/ report
[CHEMMU2_K01] Knows the limitations of her/his own knowledge; understands the need for further education and can inspire other people to do so.	-Student is critical in expressing opinions and is open to the opinions of co-discussants - Student is active in expanding knowledge and appreciates the need for continuous learning.	[SK1] oral statement/conversation/ discussion

Subject contents

Evaluation of measurement errors. Basics of potentiometry; the use of potentiometric method to determine the values of acid-base and complex equilibrium constants in solutions; the use of theoretical methods for the estimation of the potentiometric curves; methods to phase transitions studies in biologically active compounds with the use of the differential scanning calorimetry; circular dichroism; energy effects of physical and chemical changes; definitions and abbreviations used in the thermal analysis, examples; isothermal titration calorimetry; the scheme and operating principles of the TG, DTA and DSC anlyzer; UV-vis spectroscopy, fluorescence spectroscopy and NMR spectroscopy in chemical analysis; the use of theoretical methods to determine the values of acid-base equilibrium constants.

Prerequisites and co-requisites

knowledge of the sources of absorption spectra of inorganic compounds, knowledge of the vocabulary used in chemical spectroscopy; competences in interpretation of UV-Vis and IR spectra, knowledge of basic instrumental techniques; Basic knowledge of the structure and properties of amino acids and peptides

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Positive grade from the colloquium on the topic presented in the lecture based on program content.	50.0%	100.0%

Recommended reading

Basic literature	A. Literatura wymagana do ostatecznego zaliczenia zajęć (zdania egzaminu): A.1. wykorzystywana podczas zajęć http://www.shu.ac.uk/schools/sci/chem/tutorials/molspec/uvvisab1.htm http://www.cem.msu.edu/~reusch/VirtualText/Spectrpy/UV-Vis/spectrum.htm A2. Literatura studiowana samodzielnie przez studenta: D. A. Skoog, D.M. West, F.J. Holler Fudamentals of Analytical Chemistry J. Kenkel Analytical Chemistry for Technicians T. Jasiński Analiza miareczkowa w środowiskach niewodnych J. Minczewski, Z. Łada Miareczkowanie potencjometryczne J. Minczewski, Z. Marczenko Chemia analityczna S.F.A. Kettle Fizyczna chemia nieorganiczna S.J. Lippard, J.M. Berg Podstawy chemii bionieorganicznej G.W.H. Höhne, W.F. Hemminger, H.J. Flammersheim Differential Scanning Calorimetry A. Molski Wprowadzenie do kinetyki chemicznej
Supplementary literature	Thematic current scientific publications
eResources addresses	

Example issues/ example questions/ tasks being completed

1. What is the heat capacity of a substance with a mass of 2 kg if its specific heat is 1.25 kJ/kg*K (we assume T [K] = const.).
2. What type of spectroscopy is circular dichroism spectroscopy?Justify your answer.
3. Using information from NMR measurements for biological polymers, e.g. peptides, is it possible to reliably visualize the shape of the compound structure occurring in solution using molecular dynamics calculations? Justify your answer.
4. What types of experiments are carried out using the ITC microcalorimeter?

Work placement

Not applicable