University of Gdańsk

Subject card

Subject name and code	Analytical chemistry, PG_00050719		
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	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	3	ECTS credits	3.0
Learning profile	academic	Assessment form	exam
Conducting unit	Department of Analytical Chemistry -> Faculty of Chemistry -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr Dorota Zarzeczańska	
	Teachers	dr Dorota Zarzeczańska	

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

introduction of the principles of division of cations and anions into analytical groups,

acquainting with the basic methods used in the quantitative and qualitative analysis of inorganic compounds,

introduction of themethods of identifying cations and anions

Learning outcomes

Course outcome	Subject outcome	Method of verification
[CHEML3_U02] Performs analyses using experimental methods and draws conclusions based on them.	1. describes the performance of alkalimetric, redoximetric, precipitation and complexometric titration determinations as well as weighing determinations in accordance with the analytical recipe 2. recognizes the end point of the titration	[SU4] test/exam - oral or written
[CHEML3_W12] Characterises the basic principles of health and safety at work in a chemical laboratory; knows and describes the hazards associated with working with hazardous substances, ways to counteract these hazards and rules of conduct during an accident.	Characterizes the basic principles of health and safety procedures at the analytical laboratory.	[SW4] test/exam - oral or written
[CHEML3_W04] Characterises the basic methods of chemical compound analysis.	1. recognizes the analytical effects of characteristic reactions performed in during qualitative analysis. 2. based on the reactions carried out, identifies and qualifies ions for appropriate analytical groups according to the Fresenius and Bunsen taxonomy.	[SW4] test/exam - oral or written
[CHEML3_U09] Is able to learn independently.	Predicts the course of a reaction in a solution based on the amount and properties of the solute.	[SU4] test/exam - oral or written
[CHEML3_W08] Demonstrates knowledge of basic computational methods to solve problems in chemistry, physics, mathematics.	Selects a calculation method to determine the amount of a substance in a solution	[SW4] test/exam - oral or written
[CHEML3_W07] Understands and describes physicochemical patterns, phenomena and processes using the language of mathematics.	1. Illustrates the titration process with an appropriate curve 2. lists and explains the operation of indicators used in titration determinations 3. Illustrates and describes using chemical equations the reactions that occur during qualitative and quantitative determinations.	[SW4] test/exam - oral or written
[CHEML3_U03] Selects the appropriate equipment and laboratory apparatus for conducting uncomplicated chemical experiments.	Names glassware and laboratory equipment used in qualitative and quantitative analysis.	[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.	1.Recognizes and predicts sources of errors in analysis and follows occupational health and safety rules in the laboratory. 2. Exercises caution when handling chemicals	[SK1] oral statement/conversation/ discussion

Subject contents

Chemical reactions in analytical chemistry. Equilibria in solutions. Determination and detectability of metal ions, anions and inorganic compounds. Collection and preparation of samples for analysis. Basic concepts of classical qualitative analysis. Analytic division of cations by Fresenius. Group reagents and conditions for their use. Characteristic reactions of cations and analytical effects. Division of anions into analytical groups according to Bunsen, characteristic reactions of selected anions. Basic concepts of classical quantitative analysis. Titration analysis - general part, division of titration methods (alkacimetry, redoximetry, complexometry, precipitation titration analyzes), EqP (equivalence point) and EP (end point) concepts, types of titrimetric methods (direct, indirect and inverse). Weight analysis - phenomena related to precipitation and dissolution of sediments. Evaluation of the analysis results.

Prerequisites and co-requisites

-completed general chemistry course

-using basic laboratory glass and applying the rules of work in a chemical laboratory,writing chemical reactions taking into account the stoichiometry of reactions and determining the products, e.g. sediment, gas, etc., describing chemical equilibrium in the solution using chemical reactions, balancing the oxidation and reduction reactions; calculations based on chemical reactions, calculating molar concentrations, percentages, calculating the pH of electrolytes

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
written exam: accounting tasks (50%), open questions (20%) and closed questions (30%)	51.0%	100.0%

Recommended reading	Basic literature	J. Minczewski i Z. Marczenko, Chemia analityczna 1 i 2, PWN Warszawa T. Lipiec, Z.S. Szmal, Chemia analityczna z elementami analizy instrumentalnej, PZWL Warszawa H. Bentkowska, Chemia analityczna jakościowa, skrypt PG A. Cygański, Chemiczne metody analizy ilościowej, WNT A. Persony , Chemia analityczna. Podstawy klasycznej analizy ilościowej, Medyk
	Supplementary literature	D. Harvey, Modern Analytical Chemistry, McGraw Hill Companies, Inc. W. Gorzelany, A. Śliwa, J. Wojciechowska, Półmikroanaliza jakościowa, PWN Warszawa
	eResources addresses	

Example issues/ example questions/ tasks being completed	Sample open tasks for the oral and written exam 1.Characterize the conditions for the precipitation of group I cations. List the ions separated. Write reactions with a group reagent. Why can't concentrated hydrochloric acid be used to precipitate chlorides of group I cations? 2. Why do silver chloride and bromide dissolve in ammonia solution, but silver iodide does not dissolve? 3. What is AKT and how does it apply to the analysis of group II cations? 4. Why, when detecting cadmium (II) and copper (II) ions next to each other, during the analysis after dissolving the sulfides in concentrated nitric acid, do we add ammonia to make the reaction alkaline and only then add cyanide ions? Write the reactions described above and describe their color effects. What would happen if we added cyanide ions to an acidic solution? 5. Discuss in detail what group III reagent is. cations and why? 6. What is the systematic analysis of cations according to Fresenius? 7. What is fractional precipitation of halides? 8. What is the division of anions into analytical groups according to Bunsen? Provide example anions for each group. 9. How to detect bromide and iodide ions side by side using chlorine water? Provide the colors of substances present in aqueous and organic solutions during this determination. 10. What is the annular reaction? What ions do we use it to remove? Record the reactions taking place and describe the analytical effects. 11. What are alkalimetric indicators and what is their color change - describe with an example. 12. Draw a titration curve of sodium hydroxide with hydrochloric acid solution. Mark the equivalence point and titration step. Remember to label the axis. 13. What is it and what properties should the basic substance have? 14. Write a redox reaction in which the electrochemical potential depends on pH. Write the Nernst equation for this reaction. 15. Provide the types of indicators used in redoximetry (3) and describe their operation. 16. Discuss setting the titer of sodium thiosulfate (give the basic substance, write the reaction, give the indicator, etc.). 17. Discuss the iodometric determination of copper (substrates, what and why, the sequence of activities performed, indicator, titrant, reactions taking place during the determination). 18. Describe the determination of chloride using Mohr's method. What is the chromate error and how do we prevent it? 19. List and briefly describe precipitation methods for chloride determination. 20. What are metal indicators in complexometry? What conditions should an indicator for complexometric titration meet? Give an example of a metal indicator.

	21. What is EDTA? - provide the structural formula, full name, application, properties. 22. Describe the gravimetric determination of iron(III). Why should a precipitate not be left above the solution when determining iron (III) by weight? 23. Describe the effect of a foreign ion in the precipitation of sediments, justify your answer? 24. Describe the common ion effect in the precipitation of sediments, justify your answer? 25. What are the basic types of sediments you know, briefly describe their properties 26. Discuss the types of complexometric determinations.PrześlijopiniępPanele boczneHistoriaZapisane
Work placement	Not applicable

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