University of Gdańsk

Subject card

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| Subject name and code | Analytical chemistry, PG_00052416 | | |
| Field of study | Chemical Business | | |
| Date of commencement of studies | October 2025 | Academic year of realisation of subject | 2026/2027 |
| Education level | Bachelor's studies | Subject group | Obligatory subject group in the field of study<br>Subject group related to scientific research 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 | 2.0 |
| 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 | | |

**Lesson types**

| Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
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| 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 |
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| Number of study hours | 30 | 5.0 | 15.0 | 50 |

**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 |
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| [BCHINŻ_W07] Describes the construction and operating principles of basic scientific, technological and control-measuring apparatus. | describes and can sketch laboratory equipment and glassware necessary to perform classical analysis | [SW4] test/exam - oral or written |
| [BCHINŻ_U08] Uses the chemical nomenclature and engineering terminology properly. | Appropriately uses chemical nomenclature and engineering terminology typical of analytical chemistry. | [SU4] test/exam - oral or written |
| [BCHINŻ_W02] Enumerates basic laws and theories in chemistry, physics and mathematics necessary to formulate and solve simple engineering tasks. | 1. Provides the composition of group reagents.<br>2. Explains the working principles of group reagents and analyte-specific reagents.<br>3. Defines the basic problems of the theory describing the course of ionic reactions in solution.<br>4. Illustrates the course of the titration with the appropriate curve.<br>5. Illustrates and describes by means of chemical equations reactions taking place during qualitative and quantitative determinations.<br>6. Lists and explains the modus-operandi of indicators used in the quantitative titration. | [SW4] test/exam - oral or written |
| [BCHINŻ_W10] Applies safety and hygiene principles when working on a test and measurement stand or in the field. | Characterizes the basic principles of health and safety procedures at the analytical laboratory. | [SW4] 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. | plans and selects laboratory equipment and glassware necessary to perform classical analysis | [SU4] test/exam - oral or written |
| [BCHINŻ_K04] Demonstrates responsibility for the safety of her/ his own and others' work. | Recognizes and predicts sources of errors in analysis and follows occupational health and safety rules in the laboratory. | [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 |
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| written exam: accounting tasks (50%), open questions (20%) and closed questions (30%) | 51.0% | 100.0% |

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

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| Example issues/ example questions/ tasks being completed | Sample open tasks for the oral and written exam<br><br>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?<br><br>2. Why do silver chloride and bromide dissolve in ammonia solution, but silver iodide does not dissolve?<br><br>3. What is AKT and how does it apply to the analysis of group II cations?<br><br>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?<br><br>5. Discuss in detail what group III reagent is. cations and why?<br><br>6. What is the systematic analysis of cations according to Fresenius?<br><br>7. What is fractional precipitation of halides?<br><br>8. What is the division of anions into analytical groups according to Bunsen? Provide example anions for each group.<br><br>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.<br><br>10. What is the annular reaction? What ions do we use it to remove? Record the reactions taking place and describe the analytical effects.<br><br>11. What are alkalimetric indicators and what is their color change - describe with an example.<br><br>12. Draw a titration curve of sodium hydroxide with hydrochloric acid solution. Mark the equivalence point and titration step. Remember to label the axis.<br><br>13. What is it and what properties should the basic substance have?<br><br>14. Write a redox reaction in which the electrochemical potential depends on pH. Write the Nernst equation for this reaction.<br><br>15. Provide the types of indicators used in redoximetry (3) and describe their operation.<br><br>16. Discuss setting the titer of sodium thiosulfate (give the basic substance, write the reaction, give the indicator, etc.).<br><br>17. Discuss the iodometric determination of copper (substrates, what and why, the sequence of activities performed, indicator, titrant, reactions taking place during the determination).<br><br>18. Describe the determination of chloride using Mohr's method. What is the chromate error and how do we prevent it?<br><br>19. List and briefly describe precipitation methods for chloride determination.<br><br>20. What are metal indicators in complexometry? What conditions should an indicator for complexometric titration meet? Give an example of a metal indicator. |

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

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