Analytical Chemistry: Introduction (C003976)

Valid as from the academic year 2017-2018

Course Specifications

Lecturers in academic year 2018-2019
Vanhaecke, Frank WE08 lecturer-in-charge

Course offerings and teaching methods in academic year 2018-2019
A (semester 1) Dutch lecture 22.5 h
seminar: coached exercises 15.0 h

Offered in the following programmes in 2018-2019
Bachelor of Science in Chemistry

Teaching languages
Dutch

Keywords
Chemical equilibrium, titrimetry (volumetry), gravimetry, sampling, data evaluation

Position of the course
The course Analytical Chemistry: Introduction is the first course within the educational curriculum analytical chemistry. The aim and importance of analytical chemistry is discussed. The course aims at a more profound insight into chemical equilibrium and provides the students with the tools for problem-solving in this context. Important basic concepts in analytical chemistry and their relevance are elucidated. The importance of adequate sampling is highlighted and a number of sampling and sample pretreatment approaches are covered. A profound insight into the wet-chemical analysis techniques titrimetry (or volumetry) and gravimetry is aimed at. Finally, tools are provided for data analysis based on statistics.

Contents
- Introduction
  - Definition and relevance of analytical chemistry
  - Qualitative and quantitative analysis
  - Course of a chemical analysis
- Chemical equilibrium
  - Introduction
  - Ladder diagram
  - A general approach for solving equilibrium problems
  - Use of R for solving equilibrium problems
  - Buffer solutions
  - Activity
- Basic concepts and skills in analytical chemistry
  - Expressing analysis results (units of concentration)
  - Stoichiometric calculations
  - Figures of merit: accuracy, precision, sensitivity, detection and quantification limit, selectivity and sensitivity, robustness
  - Selecting an analytical method
- Data evaluation
  - Measurement uncertainty and distribution of measurement results
  - Statistical analysis of analytical data (including use of R)
- Sampling and sample pretreatment
  - The importance of adequate sampling
  - Sampling strategy
  - Simple methods for separation of analyte and interference

Course size (nominal values; actual values may depend on programme)
Credits 4.0 Study time 120 h Contact hrs 37.5 h

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(Approved)
- Gravimetric methods
  - Precipitation gravimetry
  - Volatilization gravimetry
  - Particulate gravimetry
- Titrimetric (volumetric) methods
  - Introduction
  - Acid-base titrations
  - Complexation titrations
  - Redox titrations
  Precipitation titrations

Initial competences
Having followed the courses "Chemistry: Structure of Matter" and "Chemistry II: Reactions or having obtained their competences via equivalent courses.

Final competences
1. The student has obtained insight into the aim and importance of analytical chemistry.
2. The student has obtained a more profound insight into chemical equilibrium and has enhanced skills for solving equilibrium problems.
3. The student is aware of the most important aspects of analysis methods (figures of merit) and analysis data (distribution, uncertainty).
4. The student has acquired a profound understanding of the basic principles and the capabilities and limitations of titrimetric (volumetric) and gravimetric methods.
5. The student is aware of the importance of adequate sampling and sample preparation prior to the analysis.
6. The student can use simple statistical methods for data analysis.

Conditions for credit contract
Access to this course unit via a credit contract is determined after successful competences assessment.

Conditions for exam contract
This course unit cannot be taken via an exam contract.

Teaching methods
Lecture, seminar: coached exercises

Learning materials and price
The students can download the relevant chapters of the course notes ‘Analytical Chemistry 2.0’ (Harvey). These course notes (in English) are freely distributed via chem.libretexts.org. The PowerPoint files used in the lectures will be made accessible via Minerva.
Each student disposes of their own computer.

References
- Analytical Chemistry 2.0, D. Harvey, http://chem.libretexts.org/Textbook_Maps/Analytical_Chemistry_Textbook_Maps/Map%3A_Analytical_Chemistry_2.0_(Harvey)

Course content-related study coaching
Questions can be posed via email, after lectures or during a personal meeting after making an appointment by e-mail.

Evaluation methods
end-of-term evaluation

Examination methods in case of periodic evaluation during the first examination period
Written examination with open questions, open book examination

Examination methods in case of periodic evaluation during the second examination period
Written examination with open questions, open book examination

Examination methods in case of permanent evaluation
Possibilities of retake in case of permanent evaluation
not applicable

(Approved)
Extra information on the examination methods

Theoretical part: written examination
Problem-solving part: written examination with open book

Calculation of the examination mark

The theoretical part and the problem-solving part each account for 50% of the total score. Students who are absent without any well-justified reason or who do not participate to both parts of the evaluation, do not pass the exam for this course unit.