VNIVERSITAT DE VALÈNCIA

Course Guide
34228 Analytical chemistry I

COURSE DATA

Data Subject	
Code	34228
Name	Analytical chemistry I
Cycle	Grade
ECTS Credits	4.5
Academic year	2015 - 2016

Study (s)

Degree	Center	Acad. year	Period
1108 - Degree in Chemistry	Faculty of Chemistry	2	First term

Subject-matter

Degree	Subject-matter	Character
1108 - Degree in Chemistry	6 - Analytical chemistry	Obligatory

Coordination

Name	Department
CHISVERT SANIA, ALBERTO	310 - Analytical Chemistry

SUMMARY

Analytical Chemistry I is the first course in the subject area of Analytical Chemistry on the degree in Chemistry. As such, it is the starting point for the teaching of Analytical Chemistry and of great importance for addressing the later courses related to that area.

This course introduces the basic concepts related to the analytical process, basic operations, analytical properties and the expression of results. Students become aware of what Analytical Chemistry represents today and how it contributes to today's society.

Following an introduction to sample treatment and preparation, the course focuses on classical analytical techniques and in particular on reactions in solution, i.e. volumetric and gravimetric analysis. The contents of General Chemistry II on chemical equilibrium will therefore prove extremely useful for completing this course. Moreover, the contents of Analytical Chemistry I will be reinforced on Laboratory of Analytical Chemistry I, which students will complete in the next semester.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

Basic knowledge: Nomenclature and formulation. Stoichiometric calculations. Basis of equilibria in solution. Identifying acid-base and redox characteristics of species. Accuracy and precision. Basic mathematical and statistical calculations. Errors. Propagation of uncertainty. Significant digits.

OUTCOMES

1108 - Degree in Chemistry

- Develop capacity for analysis, synthesis and critical thinking.
- Show inductive and deductive reasoning ability.
- Demonstrate leadership and management skills, entrepreneurship, initiative, creativity, organization, planning, control, leadership, decision making and negotiation.
- Solve problems effectively.
- Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using information technology, as appropriate.
- Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional.
- Acquire a permanent sensitivity to quality, the environment, sustainable development and the prevention of occupational hazards.
- Interpret the variation of the characteristic properties of chemical elements according to the periodic table.
- Demonstrate knowledge and understanding of essential facts, concepts, principles and theories related to the areas of chemistry.
- Solve qualitative and quantitative problems following previously developed models.
- Recognise and analyse new problems and plan strategies to solve them.
- Evaluate, interpret and synthesise chemical data and information.
- Interpret data from observations and measurements in the laboratory in terms of their significance and the theories that underpin them.
- Relate theory and experimentation.
- Recognise and evaluate chemical processes in daily life.

- Understand the qualitative and quantitative aspects of chemical problems.
- Develop sustainable and environmentally friendly methods.
- Students must be able to apply their knowledge to their work or vocation in a professional manner and have acquired the competences required for the preparation and defence of arguments and for problem solving in their field of study.
- Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.
- Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.
- Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.
- Express oneself correctly, both orally and in writing, in any of the official languages of the Valencian Community.
- Have basic skills in the use of information and communication technology and properly manage the information obtained.

LEARNING OUTCOMES

On completion of Analytical Chemistry I, students should be able to:

• Clearly explain phenomena and processes related to analytical chemistry. (CG1, CG2, CE2, CE13)

• Understand and use bibliographical and technical information related to analytical chemistry. (CG7, CE16)

• Recognize and evaluate the behaviour of chemicals in everyday life. (CE23)

• Use technical information to choose the correct method for solving a real problem. (CG3, CG4)

• Apply the quality criteria of the analytical results. (CG10)

• Demonstrate knowledge of sustainable analytical methods. (CE25)

• Clearly explain experimental phenomena using the theories that support them. (CE20, CE22)

• Demonstrate interpersonal skills also from a gender perspective. (CG6)

• Demonstrate sensitivity to environmental issues. (CG10)

• Demonstrate the ability to manage information with rigour. (CG7)

• Solve problems with rigour. (CG4, CG6, CE14, CE15, CE24)

These learning outcomes should ensure that on successful completion of Analytical Chemistry I students will be able to:

• Define the concept of Analytical Chemistry.

• Explain the role of Analytical Chemistry in its current context.

• Define and use basic concepts such as analyte, interferent, sample, technique, method, procedure, and protocol, etc. appropriately.

• Define and classify the main analytical properties.

• Relate the analytical properties with the methods and analytical results.

• Describe and distinguish between the various steps in an analytical process and assess their relevance.

• Describe and justify the principles behind the basic operations in the treatment of analytical samples.

• Define and distinguish between systematic and random errors and describe their relationship with the analytical properties.

• Express an analytical result correctly.

• Describe the fundamentals of classical qualitative analysis and justify its analytical interest.

• Define the scope of volumetric methods and describe their rationale, highlighting the features the reactions must have if they are to be used in these methods.

• Describe the fundamentals of direct and back titrations, highlighting the differences in the experimental procedures.

• Calculate the side-reaction coefficients and conditional constants, together with their influence on the titration curves.

• Describe the features that primary and secondary standards should have.

• Select the appropriate chemical indicator and calculate the titration error.

• Explain the basis for the main applications in volumetric analysis.

• Determine the analyte concentration in a sample by titrimetric analysis.

• Describe the features that must be met in a chemical reaction if it is to be used in gravimetric analysis.

• Describe the steps involved in a gravimetric procedure.

• Describe the characteristics of the precipitates and the factors that influence a gravimetric procedure.

• Explain the basis for the main applications of gravimetric analysis.

• Determine the analyte concentration in a sample obtained by gravimetric analysis.

DESCRIPTION OF CONTENTS

1. Introduction to Analytical Chemistry

Introduction to analytical chemistry. Definition of Analytical Chemistry. Basic terminology. Analytical properties. Classification of analytical methods. Steps of the analytical process.

2. Analytical Sampling and Sample Treatment

Analytical sampling and sample treatment. Definition. The importance of representativeness in the sampling. Basic operations of sampling (in solid, liquid and gaseous states). Basic operations of sample treatment in Analytical Chemistry: dissolution, leaching, wet and dry mineralization, liquid-liquid extraction, solid-phase extraction, distillation, evaporation, filtration, centrifugation, precipitation, masking and derivatisation.

3. Introduction to Classical Qualitative Analysis

Introduction to classical qualitative analysis. Basis of qualitative analysis. False positives and false negatives. Applications: identification of chemical species.

4. Introduction to Classical Quantitative Analysis

Introduction to classical quantitative analysis. Classification. Fundamentals of volumetric analysis. Requirements of the reactions used in titrimetric analysis. Titration curves. Equivalence point and end point. Titration error. Primary and secondary standards (preparation, standardization and conservation). Direct, indirect and back titrations. Evaluation and expression of results.

5. Fundamentals of Gravimetric Analysis: Gravimetries

Fundamentals of gravimetric analysis. Principles. Gravimetric factor. Characteristics of the precipitates. Basic steps of gravimetric analysis based on precipitation. Applications.

6. Acid-base Titrimetric Analysis

Acid-base titrimetric analysis. Introduction. Titration curves. End point detection: acid-base indicators. Selecting the indicator. Error assessment. Applications.

7. Titrimetric Analysis Based on Complex Formation

Titrimetric analysis based on complex formation. Introduction. Effect of the medium on the titration curve: influence of side reactions, calculation of side-reaction coefficients and conditional constant. Titration curves. End point detection: metallochromic indicators. Selecting the indicator. Error assessment. Applications.

8. Titrimetric Analysis Based on Precipitation

Titrimetric analysis based on precipitation. Introduction. Effect of the medium on the titration curve. Titration curves. End point detection. Error assessment. Applications.

9. Redox Titrimetric Analysis

Redox titrimetric analysis. Introduction. Effect of the medium on the titration curve. Titration curves. End point detection: redox indicators. Selection of the indicator. Error assessment. Applications.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	38,00	100
Tutorials	7,00	100
Study and independent work	32,50	0
Preparation of evaluation activities	16,00	0
Preparing lectures	6,00	0
Preparation of practical classes and problem	13,00	0
TOTAL	**112,50**	

TEACHING METHODOLOGY

The course will be taught using the following methods:

- Lectures
- Participatory classes
- The solving of exercises
- Seminars

• Information searches

• Problem-based learning

• Analyses and case studies

The course will comprise lectures on theoretical concepts, problem-based learning sessions, group tutorials and seminars.

The lectures will present an overview of each topic on the course. The problem-based learning sessions will provide the basis for solving problems related to the theoretical contents. Outside the classroom, students will answer questions and solve problems set by the lecturer in order to consolidate the knowledge they have acquired.

In the tutorials, students will discuss practical analytical problems and their ability to solve these problems will be evaluated. The tutorials will also allow students to raise any queries they have in relation to the questions and problems set by the lecturer.

In the seminars, practical cases related to the contents of the lectures will be explained.-

Students will also be able to raise their queries about the questions and problems set by the lecturer and submit their work for evaluation on these matters throughout the course.

EVALUATION

The following system of evaluation will be used:

• Written, oral or practical examinations.

• Continuous assessment of each student-based classroom activity, student participation, and the student's degree of involvement in the teaching-learning process.

Learning will be evaluated by taking into account all the aspects stipulated in the Methodology section of this syllabus. Students who do not attend class regularly must choose mode B.

FIRST CALL

Mode A

The final grade will be calculated from the scores obtained in the written examination (70%) and the continuous assessment (30%)

The score on each of these two parts must be at least 4.5 in order to apply the average.

The minimum overall grade to pass the course is 5.0.

Mode B

Students may request to be evaluated solely by an examination of the course contents developed during the lectures, tutorials and seminars. This examination will determine whether the student has acquired the skills and knowledge taught by the lecturer throughout the course.

SECOND CALL

At the second call students will take an examination also of the course contents developed during the lectures, tutorials and seminars to determine whether the student has acquired the skills and knowledge taught by the lecturer throughout the course.

REFERENCES

Basic

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