

30801 - Basics of analytical chemistry

Syllabus Information

Academic Year: 2021/22

Subject: 30801 - Basics of analytical chemistry

Faculty / School: 105 - Facultad de Veterinaria

Degree: 568 - Degree in Food Science and Technology

ECTS: 6.0

Year: 1

Semester: First semester

Subject Type: Basic Education

Module:

1. General information

2. Learning goals

3. Assessment (1st and 2nd call)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures, practice sessions and autonomous work and study.

40 hours of lectures in the classroom plus 20 hours of practical classes in the chemical lab and in the computer room, in addition to all the work that the student needs to carry out to follow the course and complete all the tasks.

The main material needed to follow the sessions will be available in the Moodle 2.0 platform, and the student is expected to review it in detail before every class. The goal of the sessions is to expose only the most relevant and/or more complicated aspects. It is the responsibility of the student, who can otherwise ask the lecturer any questions during the tutorial activities, to read and understand the most descriptive aspects of the program. At least 25% of the duration of the lectures will be allocated to the application of the concepts exposed to problem solving and case studies. Discussion of the most important concepts with the students will be promoted.

Practice sessions will be held in sessions of 4 hours. Each group is expected to complete one practice session per week. Students should read in advance the guide available in Moodle for practice sessions in order to be able to follow every procedure and review the necessary concepts so that they can deliver a written report in the model provided at the end of each session. After completing all the practices, a 4-hour session will be scheduled per group, during which the students will present a practice and every student will discuss with the teacher the reports completed, the calculations made and the qualification of such reports.

S

Students must follow the regulations described in:

- Prevention: A guide for students at the University of Zaragoza:
https://uprl.unizar.es/sites/uprl.unizar.es/files/archivos/Procedimientos/guia_preventiva_para_estudiantes.pdf
- Manual de seguridad en los laboratorios de la Universidad de Zaragoza y normas marcadas por la Unidad de Prevención de Riesgos Laborales:

https://uprl.unizar.es/sites/uprl.unizar.es/files/archivos/Procedimientos/manual_de_seguridad_en_los_laboratorios_de_la_

<https://uprl.unizar.es/inicio/manual-de-procedimientos>

<https://veterinaria.unizar.es/sites/veterinaria.unizar.es/files/archivos/PREVENCIÓN/COVID/seguridadpracticasccta.pdf>

In addition, students will follow as well any instructions related to biosecurity given by the professor

4.2. Learning tasks

This course includes the following learning tasks:

Section I: Fundamentals of Analytical Chemistry (3.6 ECTS)

- **Lectures** (25 hours). It includes at least 6 hours devoted to problem-solving focused on the calculation of analytical results and on basic significance tests.
- **Practice sessions** (12 hours). Designed to learn to handle the basic material of an Analytical Chemistry lab, to properly execute the different steps of an analytical procedure and their influence on the results, as well as to evaluate the quality of the analytical results.
- **Autonomous work and study** (10 hours). Detailed as follows:
 - 10 hours devoted to complete the activities of the course ?Basic digital competence?, available in Moodle and prepared and presented in class by personnel from the Library, and to answer the questionnaires upon completion of a relevant theoretical item, which will be also available in Moodle, .

Section II: Analytical techniques. Classic vs. Instrumental analysis (2.4 ECTS)

- **Lectures** (15 hours). Sessions last one hour, including at least 5 hours devoted to problem-solving.
- **Practice sessions** (8 hours). Focused on the comparison between classical and instrumental techniques and their impact on the analytical procedure.
- **Autonomous work and study** (7 hours) detailed as follows:
 - 3 hours of individual work, devoted to answer the questionnaires, which will be available in Moodle, upon completion of a relevant theoretical item.
 - 4 hours of work consisting in meeting with the lecturer and discussing with him about the practical classes, the calculations carried out and the answers provided to the reports. This activity will be carried out in the same groups organized for the practice sessions.

4.3. Syllabus

This course will address the following topics:

Section I: Fundamentals of Analytical Chemistry

- **Topic 1.** Introduction to Analytical Chemistry. Purpose of Analytical Chemistry. The analytical signal. Examples of analytical signals. Classifications.
- **Topic 2.** Treatment of the analytical signal. Obtaining quantitative results. Standards in Analytical Chemistry. Error and imprecision of the measurements. Statistical treatment of quantitative results. Accuracy of the determinations. Treatment of qualitative signals.
- **Topic 3.** The analytical process. Difficulties in obtaining the analytical signal. Amount of analyte required to generate the analytical signal. Interferences affecting the analytical signal. Development of the analytical process. General characteristics of the analytical process.
- **Topic 4.** The analytical problem. Purpose of the analytical process. Analytical properties. Bibliography in Analytical Chemistry. Searching for scientific information. Quality of the analytical results.
- **Topic 5.** Evaluation of analytical results. Introduction. Evaluation and reduction of the uncertainty of the results. Evaluation and reduction of the bias. Finding the causes of bias and uncertainty. The sampling problem.

Section II: Analytical techniques. Classic vs. Instrumental analysis.

- **Topic 6.** Gravimetric analysis. Introduction. Integrity of precipitation. Physical characteristics of the precipitate. Purity of the precipitate. Gravimetric applications. Analytical properties of gravimetry.
- **Topic 7.** Volumetric Analysis. Introduction. Primary standards. Indicators of the endpoint. Working technique. Precision in volumetry. Causes of error in volumetric analysis.
- **Topic 8.** Applications of volumetry. Acid-base titrations. Titrations based on complex formation. Titrations based on redox reactions. Titrations based on precipitation reactions. Indirect titrations. Analytical properties of volumetry.

4.4. Course planning and calendar

Activity	Classroom	Factor	Personal study	Total
Lectures	40	1,50	60	100

Practice sessions	20	0,5	10	30
Moodle and supervised activities			17	17
Exams			3	3
Total	60		90	150

Week 1 to 3: No activities are programmed. Instead, more lecturers are devoted to the subject ?Química General?, so that students learn all the basic chemical concepts necessary to study Analytical Chemistry.

Weeks 4 to 13: 4 lecturers of 1 hour per week. In addition, on weeks number 5, 9, 11 and 14, Moodle activities and questionnaires will be carried out.

Practice sessions will begin on week number 7 and will be held in the afternoon, according to the following distribution:

- Week 7: Working in an analytical lab. Introduction to titrimetric analysis. Basic concepts for the calculation of results. Titration I. 4 h.
- Week 8: Steps of an analytical procedure. Titration II. 4h.
- Week 9: Comparison between two different strategies to detect the end point of a titration. Titration III. 4h.
- Week 10: Other types of titrimetries. Titration IV. 4 h.
- Week 11: Sample and analyte preparation. Calibration UV-vis Molecular absorption. 4h.
- Weeks 14 and 15: Presenting information. Discussion focused on the results obtained and the reports presented. 4 h

Further information concerning the timetable (<http://veterinaria.unizar.es/gradocta/>), classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the Faculty of Sciences website and Moodle (<https://moodle2.unizar.es/add/>).

4.5. Bibliography and recommended resources

All the class presentations, problems to solve, procedures for practical classes, as well as some examples of basic calculations, questions that students must be resolved over the course, and forums to raise further questions are available at <https://moodle2.unizar.es/add/>, within the corresponding site of ?Fundamentos de Química Analítica?. Registered students can access this site using their NIA and password.