

## 30801 - Basics of analytical chemistry

### Información del Plan Docente

<b>Academic Year</b>	2016/17
<b>Academic center</b>	105 - Facultad de Veterinaria
<b>Degree</b>	568 - Degree in Food Science and Technology
<b>ECTS</b>	6.0
<b>Course</b>	1
<b>Period</b>	First semester
<b>Subject Type</b>	Basic Education
<b>Module</b>	---

### **1.Basic info**

#### **1.1.Recommendations to take this course**

#### **1.2.Activities and key dates for the course**

### **2.Initiation**

#### **2.1.Learning outcomes that define the subject**

#### **2.2.Introduction**

### **3.Context and competences**

#### **3.1.Goals**

#### **3.2.Context and meaning of the subject in the degree**

#### **3.3.Competences**

#### **3.4.Importance of learning outcomes**

### **4.Evaluation**

### **5.Activities and resources**

#### **5.1.General methodological presentation**

The learning process designed for this subject has been based upon ...

Lecturing for 40 h 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.

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All the material and documentation needed to follow the classes 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 classes 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.

Practices will be held in sessions of 4 hours. Each group is expected to complete one practical class every week. Students should read in advance the material available in Moodle for every practical class, to be able to follow every procedure and find the required information, when applicable, with the help of the lecturer, such that they can answer the questions that will be raised during the discussion prior to the beginning of the lab work, and even introduce the practice to other peers. After every practical class, students will present a written report. After completion of the practical classes, in the last session, students will discuss with the lecturer for 4 hours about the results obtained, the calculations and the possibility of using other methods available in the literature.

### 5.2.Learning activities

#### Part I: Fundamentals of Analytical Chemistry

**Activities:** 3,6 ECTS.

-25 lectures of 1h, including at least 6 h devoted to solving problems focused on the calculation of analytical results and on basic significance tests.

-12 h of practical classes, design to stress the different steps of the analytical procedure and their influence on the results, the selection of the right analytical method, calibration and the evaluation of the quality of the analytical results.

-10 h of individual work, detailed as follows:

a) 8h devoted to following the activities of the course "Information management in CTA", available in Moodle and prepared by personnel from the Library, and to answer the questionnaires, which will be also available in Moodle, upon completion of a relevant theoretical item.

b) 2 h of individual work searching for analytical information in databases.

#### Part II: Analytical techniques. Classic vs . Instrumental analysis.

**Activities:** 2,4 ECTS.

-15 lectures of 1h, including at least 5 h devoted to solving problems.

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-8 h of practical classes, focused on the comparison between classical and instrumental techniques and their impact on the analytical procedure.

-7h of work, detailed as follows:

a) 3 h of individual work, devoted to answer the questionnaires, which will be available in Moodle, upon completion of a relevant theoretical item.

b) 4 h of work consisting in meeting with the lecturer and discussing with him about the practical classes, the calculations carried out, the answers provided to the reports, and about alternatives methods found in the bibliography. This activity will be carried out in the same groups organized for the practical classes.

### 5.3.Program

**The program offered to the students to help them to achieve the expected results comprises the following activities**

#### **Part I:** Fundamentals of Analytical Chemistry

1. Introduction to Analytical Chemistry. Purpose of Analytical Chemistry. The analytical signal. Examples of analytical signals. Classifications. Searching for scientific information. 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. 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. 4. The analytical problem. Purpose of the analytical process. Analytical properties. Bibliography in Analytical Chemistry. Quality of the analytical results. 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.

#### **Part II:** Analytical techniques. Classic vs . Instrumental analysis.

6. Gravimetric analysis. Introduction. Integrity of precipitation. Physical characteristics of the precipitate. Purity of the precipitate. Analytical properties of gravimetry. Gravimetric applications. 7. Volumetric Analysis. General concepts. Requirements of a volumetric reaction. Primary standards. Influence of pH on titrations. Indicators of the endpoint. Working technique. Precision in volumetry. Causes of error in volumetric analysis. 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. 9. Introduction to instrumental analysis techniques. General concepts. Optical analysis techniques: fundamentals, applications and analytical properties. Electroanalytical techniques: fundamentals, applications and analytical properties. Other techniques.

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### 5.4.Planning and scheduling

All the information concerning the timetable and classroom for every activity programmed is detailed in the website of the Faculty of Veterinary (link: <http://veterinaria.unizar.es/gradocta/> ). This link will be updated at the beginning of each academic year.

Activity	Classroom	Factor	Personal study	Total
Lectures	40	1,50	60	100
Practical classes	20	0,5	10	30
Moodle and supervised activities			17	17
Examinations			3	3
<b>Total</b>	<b>60</b>		<b>90</b>	<b>150</b>

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

**Weeks 4 a 13:** 4 lecturers of 1 hour per week. In addition, on weeks number 5, 6, 9, 11 and 14, Moodle activities and questionnaires will be carried out.

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

- Week 7: Basic concepts for calculation of results upon completion of an analytical procedure. Calibration. 4 h.
- Week 8: Finding information on analytical procedures. Result validation. Significance tests. 4h.
- Week 9: Working in an analytical lab. Titration. 4h.
- Week 10: Steps on an analytical procedure. Titration II. 4h.
- Week 11: Sample and analyte preparation. UV-vis Molecular absorption. 4h.
- Weeks 14 and 15: Discussion focused on the results obtained and the reports presented. 4 h.

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### 5.5. Bibliography and recommended resources

All class materials, problems to solve, procedure 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.