



## IDENTIFYING DATA

### Chemistry: Chemistry Lab II

Subject	Chemistry: Chemistry Lab II			
Code	V11G201V01110			
Study programme	Grado en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Basic education	1st	2nd
Teaching language	#EnglishFriendly Spanish			
Department				
Coordinator	Bravo Díaz, Carlos Daniel Pena Pereira, Francisco Javier			
Lecturers	Arjones Fernández, Belén Bravo Díaz, Carlos Daniel Calle González, Inmaculada de la Cepero Rodríguez, Elizabeth Graña Rodríguez, Ana María Lavilla Beltrán, María Isela Mosquera Castro, Ricardo Antonio Pena Pereira, Francisco Javier Pérez Barcia, Álvaro Pérez Juste, Jorge Tojo Suárez, María Concepción			
E-mail	cbravo@uvigo.es fjpena@uvigo.es			
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General description	In this subject it is intended that students start in the chemical laboratory and learn criteria and essential manipulations to work properly, safely and respectfully with the environment. The student will become familiar with the glassware, the instrumentation and the basic operations, achieving a learning that will allow him/her to approach other more specialized laboratories. Emphasis will also be placed on the observation and preparation of a laboratory notebook.			

## Training and Learning Results

Code	
A2	Students have demonstrated knowledge and understanding in a field of study that builds upon their general secondary education, and is typically at a level that, whilst supported by advanced textbooks, includes some aspects that will be informed by knowledge of the forefront of their field of study
B2	Organization and planning capacity
C25	Safely handle chemical substances, considering their physical and chemical properties, evaluating the risks associated with their use and laboratory procedures and including their environmental repercussions
C26	Perform correctly usual procedures in the laboratory, including the use of standard chemical instrumentation for synthetic and analytical work
C27	Demonstrate the ability to observe, monitor and measure chemical processes, by systematically and reliably recording them and presenting reports of the work done
C28	Interpret data derived from laboratory observations and measurements in terms of their meaning and relate them to the appropriate theory
C29	Demonstrate ability for numerical calculations and interpretation of experimental data, with correct use of units and estimation of uncertainty
D2	Capacity for teamwork
D3	Ability to communicate in both oral and written form in Spanish and / or Galician and / or English

## Expected results from this subject

Expected results from this subject	Training and Learning Results
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Apply safety standards in the laboratory	A2	B2	C25	D2
Use correctly the basic laboratory material, including the measurement material, and properly handle chemicals and their waste	A2	B2	C25 C26	D2
Use basic laboratory techniques and interpret the obtained data	A2	B2	C25 C26 C27 C28 C29	D2
Elaborate a notebook and/or an internship report	A2	B2	C27 C28 C29	D3
Measure chemical properties	A2	B2	C26 C27 C28 C29	D2
Identify chemical substances	A2	B2	C25 C26 C27 C28	D2

## Contents

Topic	
Separation and identification of metals in aqueous solution	<ul style="list-style-type: none"> <li>- Metals that precipitate as chlorides [Ag(I), Hg(I) and Pb(II)] (1 session)</li> <li>- Metals that precipitate as sulfates [Ca(II), Pb(II) and Ba(II)] (1 session)</li> <li>- Metals that precipitate as hydroxides [Fe(III), Cr(III) and Bi(III)] (1 session)</li> <li>- Metals that form amino complexes [Cu(II), Ni(II), Co(II) and Hg(II)] and alkaline earth metals [(Mg(II))] (1 session)</li> <li>- Identification of the metals present in a sample of unknown composition (1 session)</li> </ul>
Titration	<ul style="list-style-type: none"> <li>- Acid-base titrations: standardization of a solution of sodium hydroxide with potassium hydrogen phthalate and determination of total acidity in juices (2 sessions)</li> <li>- Redox titrations: standardization of a solution of potassium permanganate with sodium oxalate and determination of iron sulphate in tablets (2 sessions)</li> </ul>
Determination of chemical properties	<ul style="list-style-type: none"> <li>- Equation of state of ideal gases (1 session)</li> <li>- Colligative properties: Ebullioscopy (1-2 sessions)</li> <li>- Determination of the electromotive force in galvanic cells (1-2 sessions)</li> <li>- Electrolytic cells: Faraday laws (1-2 sessions)</li> </ul>
Calorimetry	<ul style="list-style-type: none"> <li>- Determination of heat of solution (1 session)</li> <li>- Determination of heat of neutralization (2 sessions)</li> </ul>
Chemical equilibrium	- Study of a dissociation equilibrium (2-3 sessions)
Chemical kinetics	- Kinetic study of a chemical reaction (2 sessions)

## Planning

	Class hours	Hours outside the classroom	Total hours
Introductory activities	4	0	4
Laboratory practical	25	25	50
Laboratory practical	25	25	50
Laboratory practice	3	25	28
Essay questions exam	3	15	18

\*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

## Methodologies

	Description
Introductory activities	At the beginning of each laboratory session, the teacher will present the contents to be developed by the students.

Laboratory practical	<p>- Laboratory experiments corresponding to separation and identification of metals in aqueous solution and titrations will be carried out in 9 sessions of 3 hours.</p> <p>- Prior to the beginning of each practice, the student will find support material on MOOVI for the preparation of the experiments to be carried out. The student will be provided with questionnaires to be fill in before the start of the first practice session, where key content is collected for carrying out the practices.</p> <p>- During the development of the practices, the student will elaborate a laboratory notebook in which he / she must write down all the observations related to the experiment carried out.</p>
Laboratory practical	<p>- Laboratory experiments corresponding to the determination of chemical properties, calorimetry, chemical equilibrium and chemical kinetics will be carried out in 9 sessions of 3 hours.</p> <p>- Prior to the beginning of each practice, the student will find support material on MOOVI for the preparation of the experiments to be carried out. The student will be provided with questionnaires to be fill in before the start of the first practice session, where key content is collected for carrying out the practices.</p> <p>- During the development of the practices, the student will elaborate a laboratory notebook in which he / she must write down all the observations related to the experiment carried out.</p>

### Personalized assistance

Methodologies	Description
Laboratory practical	Each student will be able to request from the teacher the clarifications that it deems appropriate for a better understanding of the subject and the successful development of the proposed tasks. These consultations will be attended during tutorials.
Tests	Description
Laboratory practice	Each student will be able to request from the teacher the clarifications that it deems appropriate for a better understanding of the subject and the successful development of the proposed tasks. These consultations will be attended during tutorials.
Essay questions exam	Each student will be able to request from the teacher the clarifications that it deems appropriate for a better understanding of the subject and the successful development of the proposed tasks. These consultations will be attended during tutorials.

### Assessment

Description	Qualification	Training and Learning Results			
Laboratory practical - The teacher will monitor the experimental work done by the student in the laboratory sessions corresponding to separation and identification of metals in aqueous solution and titrations through observation, questionnaires and / or the laboratory notebook.  - Since it is a experimental subject, the ATTENDANCE to the laboratory sessions is COMPULSORY.	30	A2	B2	C25 C26 C27 C28 C29	D2 D3
Laboratory practical - The teacher will monitor the experimental work done by the student in the laboratory sessions corresponding to the determination of chemical properties, calorimetry, chemical equilibrium and chemical kinetics through observation, questionnaires, tasks and / or the laboratory notebook.  - Since it is a experimental subject, the ATTENDANCE to the laboratory sessions is COMPULSORY.	20	A2	B2	C25 C26 C27 C28 C29	D2 D3
Laboratory practice Two practical laboratory tests will be carried out to assess the competences and skills acquired by the student.	30	A2	B2	C25 C26 C27 C28 C29	D3
Essay questions exam Once all the practical sessions are finished, two short written tests will be carried out regarding the concrete aspects of the operations carried out in the laboratory.	20	A2	B2	C28 C29	D3

### Other comments on the Evaluation

- The absences in laboratory sessions must be duly justified by an official document. These absences will penalize the grade.
- One unexcused absence implies the direct failure of the subject.

- More than 3 excused absences will mean failing the subject.

### **First ordinary examination call**

- Attendance at more than two laboratory sessions implies that the student is already being evaluated, so that his/her qualification in the record can not be "not presented".

- It is necessary to obtain a grade higher than 4 (out of 10) in each of the sections of the evaluation to make an average. This criterion will also be applied in second call.

- The final grade will be the sum of the grades of all the sections provided that the required minimums are exceeded.

- It will be necessary to obtain a mark of more than 3 out of 10 in each of the practical laboratory tests and reach the minimum mark required in the "Laboratory practice" section (mark of more than 4 out of 10) to be able to average the rest of the evaluation elements.

- It will be necessary to obtain a mark of more than 3 out of 10 in each of the short written tests and reach the minimum mark required in the "Essay questions exam" section (mark of more than 4 out of 10) to be able to average the rest of the evaluation elements.

- In the case of not passing the subject, the grade of the record will be the weighted grade of the practical laboratory test and essay question exam.

### **Second ordinary examination call**

In second call, the evaluation will be carried out in the following way: the score obtained by the student during the course will be kept in the section "laboratory practices" (not recoverable). The rest of the sections (laboratory practice, exam) can be recovered. In the event of having passed any of the practical and/or short written tests (marks of 5 out of 10 or more), the marks obtained by the student will be retained so that he/she will only have to repeat those tests that have not been passed in the first ordinary exam call. The final grade will be the sum of the grades of all the sections as long as the required minimums are exceeded. If the subject is not passed, the grade of the record will be the weighted grade of the practical laboratory test and essay question exam.

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### **Sources of information**

#### **Basic Bibliography**

J. Guiteras, R. Rubio, G. Fonrodona, **Curso Experimental en Química Analítica**, 1, Síntesis, 2003

F. Burriel, F. Lucena, S. Arribas, J. Hernández, **Química Analítica Cualitativa**, 18, Thomson Paraninfo, S.A., 2006

S. Arribas, **Análisis Cualitativo Inorgánico**, 5, Paraninfo, 1993

P. Atkins, L. Jones, **Principios de Química**, 5, Panamérica, 2012

R. Chang, K. A. Goldsby, **Química**, 12, McGraw-Hill, 2016

R. H. Petrucci, F. G. Herring, J. D. Madura, C. Bissonette, **Química General**, 11, Pearson, 2017

#### **Complementary Bibliography**

D. P. Shoemaker, C. W. Garland, J. W. Nibler, **Experiments in Physical Chemistry**, 8, McGraw-Hill, 2008

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### **Recommendations**

#### **Subjects that are recommended to be taken simultaneously**

Physics: Physics 2/V11G201V01107

Geology: Geology/V11G201V01106

Mathematics: Mathematics 2/V11G201V01108

Chemistry: Chemistry 2/V11G201V01109

#### **Subjects that it is recommended to have taken before**

Biology: Biology/V11G201V01101

Physics: Physics I/V11G201V01102

Mathematics: Mathematics 1/V11G201V01103

Chemistry: Chemistry Lab I/V11G201V01105

Chemistry: Chemistry 1/V11G201V01104