Teaching Guide				
Identifying Data				2020/21
Subject (*)	Analytical Chemistry 1		Code	610G01011
Study programme	Grao en Química			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	1st four-month period	Second	Obligatory	6
Language	SpanishGalicianEnglish			
Teaching method	Hybrid			
Prerequisites				
Department	Química			
Coordinador	Gonzalez Castro, Maria Jose	E-mail	m.j.gonzalez.castro@udc.es	
Lecturers	Beceiro Gonzalez, Maria Elisa Gonzalez Castro, Maria Jose	E-mail	elisa.beceiro.gonzalez@udc.es m.j.gonzalez.castro@udc.es	
Web				
General description	This subject introduces the student in the Analytical Chemistry applying the chemical equilibria to the qualitative and quantitative analysis, establishing the bases of the discipline for the following academic courses. Therefore it exerts a basic role in the full Degree.			
Contingency plan	1. Modifications to the contents The contents will do not be changed 2. Methodologies *Teaching methodologies that are maintained All methodologies will be kept, just changing to virtual modality. *Teaching methodologies that are modified All methodologies will be kept in the time band that have assigned in the subject, by means of the employment of Teams or of another similar tool. Regarding the practices of laboratory, they will be substituted by virtual practices based in the practices of face-to-face teaching, presenting real examples and focusing primarily on the numerical calculations and on the assessment of quality of the results. 3. Mechanisms for personalized attention to students Tutelage sessions by Moodle, email and/or Teams, employing the most adapted mechanism in function of the needs and/or resources of the student. Students will be able to ask queries or doubts through the forum or of the email, whenever they need. The teachers will keep daily communication and register of tutelage sessions. 4. Modifications in the evaluation There will not changes in the evaluation regarding to the educational guide published. The only modification will be the replacement of the face-to-face evaluation by the same type of evaluation adapted to on line modality *Evaluation observations: All those collected in the observation section of the teaching guide will be kept 5. Modifications to the bibliography or webgraphy There will not be modifications on the bibliography. Furthermore, one of the two recommended books is available in the UDC library web page.			

Study programme competences	
Code	Study programme competences

A4	Knowledge of main types of chemical reaction and characteristics of each
A7	Knowledge and application of analytical methods
A16	Ability to source, assess and apply technical bibliographical information and data relating to chemistry
A17	Ability to work safely in a chemistry laboratory (handling of materials, disposal of waste)
A19	Ability to follow standard procedures and handle scientific equipment
A20	Ability to interpret data resulting from laboratory observation and measurement
A21	Understanding of qualitative and quantitative aspects of chemical problems
A23	Critical standards of excellence in experimental technique and analysis
A24	Ability to explain chemical processes and phenomena clearly and simply
B1	Learning to learn
B2	Effective problem solving
B3	Application of logical, critical, creative thinking
B4	Working independently on own initiative
B5	Teamwork and collaboration
C1	Ability to express oneself accurately in the official languages of Galicia (oral and in written)
C6	Ability to assess critically the knowledge, technology and information available for problem solving

Learning outcomes			
Learning outcomes	Study programme competences		
To apply the foundations of the chemical equilibria in the classical methods of analysis	A4 A7 A16 A24	B1 B2 B4	C1 C6
To learn the data handling and present the analytical results	A7 A16 A20	B1 B2 B4	C1
To understand the qualitative and quantitative aspects of the analysis	A4 A7 A20 A21 A24	B1 B2 B4	C1 C6
To acquire the basic skill in the laboratory of Analytical Chemistry (basic operations of the classical chemical analysis)	A7 A16 A17 A19 A20 A21 A23 A24	B1 B2 B3 B4 B5	C1 C6

Contents	
Topic	Sub-topic
Chapter 1: Analytical Chemistry	Definition and scopes
	Qualitative and quantitative analysis
	The analytical process
	Classification of methods and techniques

Chapter 2: Titrimetric Methods	Basic concepts, titrimetric reaction and types of Titrations Primary standards, standard solutions and standardized solutions Equivalence point and detection of the end point Titration curves Errors associated to titrimetric methods
Chapter 3: Acid-Base Titrations	Acid-Base titration theory. Titration curves Indicators for acid-base titrations. Selection of an indicator Strong acid versus strong base and vice versa Weak acid versus strong base and vice versa Titration of polyprotic acids or bases and their salts Titration of mixtures of acids or bases Acid-Base titration in nonaqueous solvents Applications
Chapter 4: Redox Titrations	Titration curves Redox indicators and their selection Oxidizing and reducing agents used prior to titration Titrations with oxidizing agents Titrations with reducing agents Determination of organic and inorganic compounds
Chapter 5: Complexometric Titrations	Coordination compounds of interest in titrimetric analysis Titration curves and the factors that affect them Metal ion indicators for chelometric titrations Titrations with polyaminocarboxylic acids
Chapter 6: Precipitation Titrations	Precipitation reactions of interest in titrimetric analysis Titration curves Titration of mixtures Detection of the end point: Mohr, Volhard and Fajans methods
Chapter 7: Gravimetric Analysis	Principles of the gravimetric analysis Steps and classification of gravimetric methods Precipitation process. Conditions for analytical precipitation Gravimetry by chemical precipitation. Treatment of precipitates Gravimetry by volatilization and absortion Gravimetric calculations
Chapter 8: Evaluation of Analytical Data	Definitions and basic concepts Statistic treatment for indeterminated errors The confidence limit Rejection of a result Tests of significance Analytical data how present them
Chapter 9: Qualitative Analysis	Application of chemical reactions to the qualitative analysis Analytical characteristics of chemical reactions (sensitivity, selectivity and safety) General and specific reagents Analytical characteristics and reagents for metal ions Analytical characteristics and reagents for anions

Module: Laboratory practice	Acid-Base Titrations Redox Titrations Complexometric Titrations Precipitation Titrations Gravimetric Analysis Evaluation of Analytical Data

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A4 A7 A21 B1	24	36	60
Problem solving	A7 A16 A20 B1 B2 B4 C1	8	18	26
Seminar	A7 A20	2	0	2
Laboratory practice	A7 A16 A17 A19 A20 A21 A23 A24 B1 B2 B3 B4 B5 C1 C6	18	18	36
Short answer questions	A4 A7 A21 B4	0	1.5	1.5
Supervised projects	A7 A16 A20 B1 B2 B4 C1	0	3	3
Mixed objective/subjective test	A4 A7 A20 A21 A24 B1 B2 C1 C6	3	18	21
Personalized attention		0.5	0	0.5
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	Description
Guest lecture / keynote speech	In the lecture classes the professor will develop the fundamental contents of the program of the subject. To make a good use of these sessions, the student will have to prepare previously the fundamental appearances of the topic to treat, employing the educational material (diagram that reflects the contents of each topic), which will be provided to the student through the Moodle platform. The student also will must read the chapter regarding to the topic to treat in the recommended bibliography
Problem solving	Classes in small groups conceived like a group of activities in which the student must participate on a direct way. They are devoted to the resolution of the bulletins of problems, which previously will have been provided to the student through the Moodle platform, and that the students will have to realise of autonomous form for discussion in these classes. Besides, in these sessions any doubts on any appearance related with the lecture sessions will be resolved.
Seminar	Initial activity, before beginning the laboratory sessions, which consists on 1 session of 2 hours. In this session, the students will be exposed to the educational methodology that will be employed in the practices of laboratory.
Laboratory practice	6 laboratory sessions of 3 hours of length, in which the student will carry out the application of the theoretical concepts studied in the classroom. Each practice owns a script and a prelaboratory exercise which will be provided to the student (through Moodle) previously to the practice sessions. The realisation of the prelaboratory exercises before starting the laboratory practice is mandatory. The scripts will have questions that the students will have to answer and deliver once finished the practices. During laboratory sessions, and on a simultaneous way to the realisation of the experiments, the student will have to elaborate a fascicle of laboratory that collect the calculations and the experimental procedures. The professor will review the notebook of each student in each laboratory session.
Short answer questions	Exams about the topics of the subject will be carried out employing short answer questions . These exams will be realised employing the Moodle platform.

Supervised projects	Siupervised learning process in small groups (3-4 students) with the aim of helping students to work independently and encouraging students to become responsible for their own learning. The proposed activities will be related with problem solving sessions. The students will work together to solve the tasks assigned by the teacher, with the aim of optimising their learning experience and that of other members of group. The activities will be discussed in a tutelage session.
Mixed objective/subjective test	Two written exams will be carried out in each one of the two official announcements of January/July. One of them will evaluate the learning of the student by means of questions of theory and applied theory and the other one will consist on the resolution of problems.

Personalized attention	
Methodologies	**Description**
Laboratory practice Problem solving Supervised projects	The classes of problem solving and laboratory practice are conceived like activities in small groups in which the student participates directly. In this way both methodologies let personalised attention to the students allowing a better follow-up and orientation. Regarding the supervised projects, for each group of students a tutelage session will be programmed for discussion of the activities and resolution of doubts. Therefore, the teacher will be able to analyse if the process of learning of the student is suitable. Besides, along the term, the students will be able to do use of the schedule of tutelage sessions for asking queries or doubts about the subject. Students with official recognition of part-time dedication and academic assistance waiver regime will be attended in a tutorships regime (by appointment). The realization of laboratory practices and assistance to problem solving sessions will be provided within the flexibility to allow coordinating schedules and material and human resources.

Assessment			
Methodologies	**Competencies**	**Description**	**Qualification**
Laboratory practice	A7 A16 A17 A19 A20 A21 A23 A24 B1 B2 B3 B4 B5 C1 C6	It will be evaluated the suitable realisation of the prelaboratory exercises, the skill in the realisation of the experimental work, the interpretation of the data obtained, as well as the correct realisation of the calculations, the answers to the questions of practices (that they will have to deliver) and the preparation of the notebook of laboratory.	20
Problem solving	A7 A16 A20 B1 B2 B4 C1	The work carried out before and during the sessions as well as the actitude and degree of participation of the student in the classes.	10
Mixed objective/subjective test	A4 A7 A20 A21 A24 B1 B2 C1 C6	Two written exams in each one of the two official announcements of January/July: one of them will consist on questions of theory and applied theory and the another one will consist on exercises focused to the resolution of problems.	55
Supervised projects	A7 A16 A20 B1 B2 B4 C1	The adequate resolution of the proposed projects, the degree of participation of the student in the tutelage session, and the quality of explanation of each activity.	5
Short answer questions	A4 A7 A21 B4	Exams to be realised through the Moodle platform about the topics of the subject by means of short answer questions.	10

Assessment comments

To pass the subject two basic requirements are needed:
1.- The realization of laboratory practice is mandatory to pass the subject.

2.-Reach a minimum qualification in the laboratory practice and in each mixed test. This minimum qualification will cannot be lower than 5 (over 10). Note that the subject will not be approved (even when the overall sum exceeds 5) if one of these particular scores do not reach 5. In this case, the subject is failed and the final qualification will be 4.5.

In the first and second opportunity, the students who carried out the laboratory practice but the obtained qualification was lower than 5, will have the opportunity to, in addition to the mixed test, perform a specific test related to the laboratory practice. The score of this test will replaced the grade obtained in practice for the overall rating.

Students who do not participate on the problem solving and supervised projects, and do not carry out the short answer questions will score 0 in these sections.

The student will obtain the qualification of No Presented when the student does not assist to the laboratory practice and neither attend to the mixed test.

In the context of "continuous evaluation" the "second opportunity" is a second opportunity of realisation of the mixed test and a specific test related to the laboratory practice. Therefore, the laboratory practice (except for students who did not get a minimum of 5), problem solving, supervised projects and short answer questions will keep the qualifications obtained along the course, whereas the qualification of the mixed test and a specific test related to the laboratory practice corresponding to second opportunity will substitute to those obtained in the first opportunity.

The students evaluated in the "second opportunity" only will be able to opt to Mark Honor if the maximum number of the Honors for the corresponding course has not covered in its whole in the "first opportunity".

For students with recognition of a part-time dedication, the evaluation will be carried out under the same criteria.

For students with academic exemption waiver assistance, conducting laboratory practices is mandatory and they will be provided within the flexibility to allow coordinating schedules and material and human resources. On the other hand, assistance to the greatest number of problem solving sessions will be provided; if students can not attend the problem solving sessions, they will make a mentored work. Therefore, these students will be evaluated by the qualifications obtained in laboratory practice (20%), in the mixed test (55%), in short answer questions (10%), in the activities of the problem solving sessions(10%)and supervised projects (5%). This will be applied to both opportunities.

Sources of information	
Basic	- SKOOG D.A., WEST D.M., HOLLER F.J. y CROUCH S.R. (2005). Fundamentos de Química Analítica . Madrid, Ed. Paraninfo - SKOOG D. A., WEST D.M. y HOLLER F. J (1997). Fundamentos de Química Analítica . Barcelona, Ed. Reverté - HARRIS, DANIEL C (2007). Análisis Químico Cuantitativo . Barcelona, Ed. Reverté O libro "Análisis Químico Cuantitativo" do autor Daniel C. Harris (Ed. Reverté SA), atópase dispoñible na web da biblioteca da UDC.

Complementary	- GUITERAS J. RUBIO R. y FONRODONA G. (2003). Curso Experimental en Química Analítica . Madrid, Ed. Síntesis - SILVA M. y BARBOSA J. (2002). Equilibrios iónicos y sus Aplicaciones Analíticas . Madrid, Ed. Síntesis - LÓPEZ CANCIO J.A. (2005). Problemas Resueltos de Química Analítica . Madrid, Ed. Paraninfo - YÁÑEZ-SEDEÑO P., PINGARRÓN J.M. y MANUEL DE VILLENA F.J. (2003). Problemas Resueltos de Química Analítica . Madrid, Ed. Síntesis - BURRIEL MARTI F., LUCENA CONDE F., ARRIBAS JIMENO S. y HERNÁNDEZ MÉNDEZ J. (2001). Química Analítica Cualitativa . Madrid, Ed. Paraninfo - HARVEY D. (2002). Química Analítica Moderna . Madrid, Ed. McGraw-Hill

Recommendations
Subjects that it is recommended to have taken before
General Chemistry 1/610G01007 General Chemistry 2/610G01008 General Chemistry 3/610G01009 Chemistry Laboratory 1/610G01010
Subjects that are recommended to be taken simultaneously
Subjects that continue the syllabus
Analytical Chemistry 2/610G01012 Instrumental Analytical Chemistry 1/610G01013 Instrumental Analytical Chemistry 2/610G01014 Advanced Analytical Chemistry and Chemometrics/610G01015
Other comments
To register on this subject it is recommended having passed the subject ?Chemical 3?

(*)The teaching guide is the document in which the URV publishes the information about all its courses. It is a public document and cannot be modified. Only in exceptional cases can it be revised by the competent agent or duly revised so that it is in line with current legislation.