Teaching Guide				
Identifying Data				2021/22
Subject (*)	General Chemistry 2		Code	610G01008
Study programme	Grao en Química			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	2nd four-month period	First	Basic training	6
Language	SpanishGalician			
Teaching method	Face-to-face			
Prerequisites				
Department	Química			
Coordinador	Sastre De Vicente, Manuel Esteban		E-mail	manuel.sastre@udc.es
Lecturers	Barriada Pereira, José Luis Canle López, Moisés Iglesias Martinez, Emilia Sastre De Vicente, Manuel Esteban		E-mail	jose.barriada@udc.es moises.canle@udc.es emilia.iglesias@udc.es manuel.sastre@udc.es
Web	campusvirtual.udc.es			
General description	This subject has to be understood in the framework of the module of Chemistry, 1st year of the Degree in Chemistry. It is the natural continuation of the subject "Chemistry 1", showing how the concepts studied there at the atomic and molecular levels express macroscopically. Thus, the fundamentals of thermochemistry, aggregation state, phase changes, mixtures and solutions, or the basis of chemical kinetics, etc., are studied. This subject prepares the student for the study of equilibrium phenomena, as well as of the physical changes matter can undergo, and of the chemical reactivity. (English lecturer: Moisés Canle)			

Contingency plan	1. Modifications to the contents. No changes 2. Methodologies. As a subject of second term, three different situations can occur: (A) total face-to-face teaching method, when there is not any restriction concerning the access to the Faculty; (B) hybrid teaching method, when there are some restrictions concerning the maximum capacity limits on spaces; (C) non-attendance teaching method. In the latter case (C), teaching method would be total non-attendance. *Teaching methodologies that are maintained. In situation (A), all methodologies are maintained. *Teaching methodologies that are modified. In situation (B), both seminars and practices will be face-to-face, although the maximum capacity limits on labs may make it necessary to substitute part of the experimental work by some virtual alternative activities. In situation (C), both guess lectures and seminars seminars will be held entirely online and the laboratory sessions will be substituted by alternative virtual activites designed by the teachers. 3. Mechanisms for personalized attention to students. Daily attention by email and forums in Moodle, tutoring by Teams at request of the students. 4. Modifications in the evaluation. No changes in situations (A) and (B), the final objective/subjective test will be face-to-face. In situation (C), the evaluation will be online via moodle. *Evaluation observations: no changes from the teaching guide. 5. Modifications to the bibliography or webgraphy. No changes in situation (A) and (B); in situation (C), links to books available in electronic format that are freely accessible to all students will be added on moodle. ADAPTATION IN THE CASE OF EXCEEDING THE CAPACITY OF THE CLASSROOMS / LABORATORIES ASSIGNED FOR PRESENTIAL TEACHING If there are capacity problems in the spaces assigned for the face-to-face activities, additional spaces will be reserved so that students can follow the activities through the Teams platform. In the case of practical activities, the number of students per group will be adapted to the capacity of the laboratory

Study programme competences	
Code	Study programme competences
A1	Ability to use chemistry terminology, nomenclature, conventions and units
A3	Knowledge of characteristics of the different states of matter and theories used to describe them
A4	Knowledge of main types of chemical reaction and characteristics of each
A5	Understanding of principles of thermodynamics and its applications in chemistry
A10	Knowledge of chemical kinetics, catalysis and reaction mechanisms
A12	Ability to relate macroscopic properties of matter to its microscopic structure
A14	Ability to demonstrate knowledge and understanding of concepts, principles and theories in chemistry
A16	Ability to source, assess and apply technical bibliographical information and data relating to chemistry
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
B2	Effective problem solving
B3	Application of logical, critical, creative thinking
B4	Working independently on own initiative
C1	Ability to express oneself accurately in the official languages of Galicia (oral and in written)
C3	Ability to use basic information and communications technology (ICT) tools for professional purposes and learning throughout life
C6	Ability to assess critically the knowledge, technology and information available for problem solving

Learning outcomes

Learning outcomes	Study programme competences		
To know the characteristics of the different states of the matter, how some properties are obtained, the theories used to describe them, or the changes of the states.	A3 A12	B3	C3
To understand the basic principles and laws of thermodynamics and their applications in chemistry (laws of thermodynamics, thermochemistry).	A4 A5	B3	C3
To know at a fundamental level, the kinetics of chemical change, including catalysis and reaction mechanisms.	A4 A10	B3	C3
To use chemical terminology, nomenclature, conventions and units to solve general chemistry (thermochemistry, states of matter, mixtures and solutions, phase transitions, elementary kinetics).	A1 A14 A16 A21	B2 B3 B4	C1 C3 C6
To connect with the macroscopic properties with the atoms and molecules properties (states of aggregation, intermolecular interactions, phase transitions, colligative properties).	A12 A14 A16	B3	C1 C3 C6
To work in the laboratory independently and with initiative.	A14 A16 A21 A23 A24	B2 B3 B4	C1 C3 C6

Contents	
Topic	Sub-topic
Gases.	-Pressure of a gas. -Gases laws: Boyle, Charles-Gay Lussac and Avogadro. -General equation of ideal gases and its applications. -Molecular kinetic theory of gases. -Real gases: van der Waals equation.
Chemical Thermodynamics.	-Basic concepts in Chemical Thermodynamics. -Heat and work: sign convention. -First law of Thermodynamics. Internal energy. -Functions of state. Enthalpy, Standard states. -Hess Law. -Standard enthalpies of formation. -Other enthalpies.
Pure liquids and solids.	-Overview of the intermolecular forces in liquids and solids. -Some properties of liquids and solids: surface tension, viscosity, lattice energy. -Phase transitions: equation of Clausius-Clapeyron. -Phase diagrams: triple and critical points.
Solutions.	-Intermolecular forces and solution process. -Solubility of solids and gases. Henry's Law. -Colligative properties of solutions: lowering of vapour pressure, elevation of boiling point, depression of freezing point and osmotic pressure

Chemical kinetics.	-Rate of reaction. Rate equation. Reaction orders. Rate constant. -Determination of rate equation: Method of initial rates and integrated equations method. -Effect of temperature on the rate of reaction: Arrhenius equation. -Theoretical models in Chemical Kinetics. -Reaction mechanism.
Practical demonstrations	-Determination of the molar mass of a volatile liquid. -Determination of the freezing point and the depression of the freezing point. -Determination of the heats of reaction at constant pressure. -Determination of the rate of a reaction. Effect of temperature.

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Guest lecture / keynote speech	A1 A3 A4 A5 A10 A12 A24	27	54	81
Seminar	A1 A4 A5 A10 A12 A14 A21 B2	9	36	45
Laboratory practice	A3 A5 A14 A16 A23 A24 B3 B4 C1 C3 C6	15	3.75	18.75
Mixed objective/subjective test	A1 A3 A4 A5 A10 A12 A14 A21 B2 B3	3.5	0	3.5
Personalized attention		1.75	0	1.75
(*)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 guest lectures the main features of the subject will be describe, as well as the basic contents.
Seminar	In the seminars the contents will be stressed in the most detail, reinforcing the concepts covered in the lectures, mainly through the resolution of questions, problems and casework. The seminar sessions will be based on the work of the students, which will be stated as the subject evolves. For an adequate use of the seminars, the work will be indicated in advance to the students who should be done in advance of each seminar session.
Laboratory practice	The practical demonstrations will develop experimental examples of the concepts discussed in the course. The attendance to practical sessions is compulsory to pass the course as a whole. Students, as indicated by the teachers, must fill a laboratory notebook. They must submit the notebook at a prefixed date. Apart from justified exceptions, notebooks will not be evaluated when delivered after the deadline.
Mixed objective/subjective test	It includes open questions, key problems, and multiple choice, multiple answer, ordering, short answer, discrimination, completion and/or association exercises.

Personalized attention	
Methodologies	Description

Guest lecture / keynote speech Seminar Laboratory practice Mixed objective/subjective test	In tutorials with students the learning process progress will be checked with reference to the different teaching methodologies planned. Teachers will be available to students to solve any type of questions on the subject in tutorials established. Part-time students and those with special academic leave permission could ask for presential or email tutorials when necessary anytime they need them.

Assessment			
Methodologies	Competencies	Description	Qualification
Seminar	A1 A4 A5 A10 A12 A14 A21 B2	Students must work before hand the contents treated in the seminar. They must also work on these contents after these sessions. They have to paid attention during the seminars and concentrate on the concepts been analysed. Students' work would be evaluated through short questions or problem solving performed sporadically.	10
Laboratory practice	A3 A5 A14 A16 A23 A24 B3 B4 C1 C3 C6	The laboratory work of the student will be considered, including the plannig of experiments and their development, the critical analysis of the results obtained, the ability to extract generalisations and obtain conclusions, etc. At the same time, skills such as initiative, communication etc, will have take into consideration. Also the quality of the work performed will be evaluated. Students must fill a lab book following teachers' indications. This lab book will be delivered before the fixed deadline. Only in exceptional, justified situations, lab books delivered after the deadline will be considered.	20
Mixed objective/subjective test	A1 A3 A4 A5 A10 A12 A14 A21 B2 B3	Every student must do a test where their problem solving ability will be evaluated. Also concepts and short description capabilities will be evaluated. Time allocated to do this test will be indicated at the beginning of it. Assessment will consider the knowledge reflected in this test, but also the quality of the results obtained.	70

Assessment comments

*Attendance to practical demonstrations is mandatory to successfully pass the subject.
*A final mark of at least 5 out of 10 (3.5 out of 7) is required in the mixed objective/subjective test. This mark will be added to the other evaluated methodologies to get the final mark.
* To pass the course, the final qualification has to be equal to or greater than 5 (out of a possible 10). If the addition of all the marks obtained in the course is equal to or greater than 5 (out of 10), but the mark achieved in the mixed objective/subjective test is less than 5, the final qualification in the subject will be 4.5 (fail).
* Any student who has attended the practical sessions or the final exam will be assessed.
* According to the rules contained in ?Probas de Avaliación e Actas de Cualificación de Grao e Mestrado?, the so-called ?second opportunity of July? is understood as a second opportunity to retake the final written exam. The mark of this second exam will be considered together with the others obtained during the course, corresponding to the other activities. The
percentages of the different contributions will be the same as those of the former "first opportunity".
* Mark Honors: priority is given in the first opportunity (January). Honors may only be granted in July if their number have not be exhausted in January final qualifications.
Part-time students:
The same evaluation criteria listed above are applied.
Students with special academic permission (according to the rules of the UDC):
The same evaluation criteria listed above are applied, but it´s not mandatory the attendance to the classroom lectures and seminars.
It is compulsory to attend computer practical sessions. It will be tried to fit the dates to the student's availability.
The final grade will be the sum of 20% of the mark obtained in the
practical sessions and 80% of the mark obtained in the mixed test. The same criteria will be applied to both opportunities.
Students who has not attended the final exam will be assessed as "non attendance".

Sources of information	
Basic	- R.H. Petrucci, W.S. Hardwood, F.G. Herring (2011). Química general, 10ª ed. . Madrid, Prentice Hall
Complementary	- T.L. Brown, H.E. LeMay, B.E. Bursten, C.J. Murphy (2009). Química, la Ciencia Central, 11ª ed. . Naucalpán de Juárez, México, Pearson Educación - R. Chang (2010). Química, 10ª ed.. México, Mc Graw Hill Interamericana - M.D. Reboiras (2007). Problemas resueltos de Química. Madrid, Thomson - J.A. López Cancio (2000). Problemas de Química. Cuestiones y ejercicios.. Madrid, Prentice Hall - C. Orozco Barrenetxea, M.N. González Delgado, A. Pérez Serrano (2011). Problemas resueltos de Química Aplicada. Madrid, Paraninfo - P. Atkins, L. Jones (2012). Principios de Química. Los caminos del descubrimiento. Madrid. Editorial Médica Panamericana - N.J. Tro (2010). Principles of Chemistry. Upper Saddle River, New Jersey, Pearson Education International

Recommendations
Subjects that it is recommended to have taken before
General Chemistry 1/610G01007 Chemistry Laboratory 1/610G01010
Subjects that are recommended to be taken simultaneously
General Chemistry 3/610G01009
Subjects that continue the syllabus
Physical Chemistry 3/610G01018 Experimental Physical Chemistry/610G01019 Advanced Physical Chemistry/610G01020
Other comments

(*)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.