



Teaching Guide

Teaching Guide				
Identifying Data				2019/20
Subject (*)	Chemistry		Code	730G03005
Study programme	Grao en Enxeñaría Mecánica			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	1st four-month period	First	Basic training	6
Language	SpanishGalician			
Teaching method	Face-to-face			
Prerequisites				
Department	Enxeñaría Naval e IndustrialQuímica			
Coordinador	Fernandez Solis, Jose Maria	E-mail	jose.maria.fsolis@udc.es	
Lecturers	Fernandez Solis, Jose Maria Rodriguez Guerreiro, Maria Jesus	E-mail	jose.maria.fsolis@udc.es maria.guerreiro@udc.es	
Web				
General description	Matter of basic training of first course, in which they give the foundations of general chemistry, inorganic, organic and applied to the engineering			

Study programme competences

Code	Study programme competences
A4	FB4 - Capacidade para comprender e aplicar os principios de coñecementos básicos da química xeral, química orgánica e inorgánica e as súas aplicacións na enxeñaría.
B1	CB01 - Que os estudantes demostren posuír e comprender coñecementos nunha área de estudo que parte da base da educación secundaria xeral e adoita encontrarse a un nivel que, aínda que se apoia en libros de texto avanzados, inclúe tamén algúns aspectos que implican coñecementos procedentes da vangarda do seu campo de estudo
B2	CB02 - Que os estudantes saiban aplicar os seus coñecementos ao seu traballo ou vocación dunha forma profesional e posúan as competencias que adoitan demostrarse por medio da elaboración e defensa de argumentos e a resolución de problemas dentro da súa área de estudo
B3	CB03 - Que os estudantes teñan a capacidade de reunir e interpretar datos relevantes (normalmente dentro da súa área de estudo) para emitiren xuízos que inclúan unha reflexión sobre temas relevantes de índole social, científica ou ética
B4	CB04 - Que os estudantes poidan transmitir información, ideas, problemas e solucións a un público tanto especializado como leigo
B5	CB05 - Que os estudantes desenvolvan aquelas habilidades de aprendizaxe necesarias para emprenderen estudos posteriores cun alto grao de autonomía
B6	B3 - Ser capaz de concibir, deseñar ou poñer en práctica e adoptar un proceso substancial de investigación con rigor científico para resolver calquera problema formulado, así como de comunicar as súas conclusións ?e os coñecementos e razóns últimas que as sustentan? a un público tanto especializados como leigo dun xeito claro e sen ambigüidades
B7	B5 - Ser capaz de realizar unha análise crítica, avaliación e síntese de ideas novas e complexas
C1	C3 - Utilizar as ferramentas básicas das tecnoloxías da información e as comunicacións (TIC) necesarias para o exercicio da súa profesión e para a aprendizaxe ao longo da súa vida.
C2	C4 - Desenvolverse para o exercicio dunha cidadanía aberta, culta, crítica, comprometida, democrática e solidaria, capaz de analizar a realidade, diagnosticar problemas, formular e implantar solucións baseadas no coñecemento e orientadas ao ben común.
C4	C6 - Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.
C5	C7 - Asumir como profesional e cidadán a importancia da aprendizaxe ao longo da vida.

Learning outcomes

Learning outcomes	Study programme competences
-------------------	-----------------------------



Capacity to comprise and apply the principles of basic knowledges of the general, organic and inorganic chemistry and his applications in the engineering.	A4	B1 B2 B3 B4 B5 B6 B7	C1 C2 C4 C5
--	----	--	----------------------

Contents	
Topic	Sub-topic
The following lessons develop the established contents in the Verification Memory, that are:	I.- Structure of the matter. Energy and kinetical of the chemical reactions II.- Chemical equilibrium: types and applications III.- Applications of the electrochemistry. Principles of instrumental analysis IV.- Bases of the industrial chemistry. Balances of matter V.- Organic and inorganic chemistry applied to the engineering
Lesson 1.- Basic concepts of General Chemistry:	Fundamental Principles of Chemistry. The atom: quantum mechanical description. Periodic table and periodic properties. Chemical link: types of link.
Lesson 2.- Thermochemistry:	Introduction: first principle of thermodynamics. Heats of reaction, enthalpy. Thermochemistry: Law of Hess. Calorimetry. Second principle of thermodynamics: entropy. Third principle of thermodynamics: spontaneity of the reaction.
Lesson 3.- Chemical Kinetics:	The rate of reaction. The rate law. Determination of the rate of reaction. Order of reaction. The collisions and of the state of transition theories. Activation energy. Reaction mechanisms. Catalysis: Catalysts.
Lesson 4.- Chemical equilibrium in gaseous phase:	Nature of the chemical equilibrium. The equilibrium constant: applications. Heterogeneous equilibria. Factors that affect chemical equilibrium: Le Châtelier's principle. Relation between equilibrium constants. Effect of changes in the temperature on the equilibrium constant.
Lesson 5.- Acid-base equilibria:	Acid-base definitions. Autoionization of water. Concept of pH: determination. Dissociation of acids and bases. Acid-base properties of the salts. Acid-base reactions. Buffer solutions. Acid-basic titrations: indicators.
Lesson 6.- Oxidation-reduction (redox) equilibria:	Methods of balancing redox equations. Electrochemical foundations: galvanic cells. Free energy and voltage of the battery. The Nernst equation. Redox titrations.
Lesson 7.- Applications of the electrochemistry:	Primary commercial cells and accumulators. Fuel cells. Electrolytic cells. Industrial applications of the electrolysis: electrodeposition. Metallic corrosion.
Lesson 8.- Principles of Instrumental Analysis:	Analytical Chemistry: concept and division. Classification of quantitative analytical methods. Instrumental analytical methods: classification. Parameters of validation of an analytical method. Evaluation of results.
Lesson 9.- Principles of Organic Chemistry:	Naming organic compounds. Functional groups. Homologous series. Isomery. Determination of molecular structures.
Lesson 10.- Saturated, unsaturated and aromatic hydrocarbons:	Classification. Saturated hydrocarbons: naming, sources, synthesis and properties. Alkenes and alkynes: structure, nomenclature, synthesis and properties. Aromatic compounds: structure, nomenclature, obtaining and properties. Benzene.
Lesson 11.- Other organic compounds:	Compounds of functional groups with simple link: alkyl halides, alcohols, phenols, ethers and amines. Compounds of functional groups with multiple links: carbonyl group compounds, carboxylic acids and his derivatives.
Lesson 12.- Bases of the Industrial Chemistry. Balances of matter:	Prime Matters that uses the chemical industry. The energy in the chemical industry. The chemical processes: examples. Diagrams of flow. The chemical products. Ecological and environmental considerations.
Lesson 13.- Organic Chemistry applied to the engineering:	Coal. Oil. Natural gas. Biomass. Natural and synthetic polymers.



Lesson 14.- Inorganic Chemistry applied to the engineering:	Metallurgy. Semiconductors. Industrial synthesis of an inorganic compound (industry of the chloride of sodium).
---	---

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student's personal work hours	Total hours
Laboratory practice	A4 B3 C5	10	5	15
Mixed objective/subjective test	A4 B1 B2 B5	4	6	10
Guest lecture / keynote speech	A4 C1 C2 C4	30	39	69
Problem solving	A4 B2 B4 B5	18	18	36
Supervised projects	A4 B6 B7 C1	2	16	18
Personalized attention		2	0	2

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

Methodologies	
Methodologies	Description
Laboratory practice	Understanding reading of the practice. Realise the experimental work. Pose and resolve the numerical calculations associated as well as the questions that pose. Examine and value the results. Draft and present the final report of the practices.
Mixed objective/subjective test	Tests written divide in two parts (theoretical and of problems) used for the evaluation of the learning of the student.
Guest lecture / keynote speech	Has a expositive function complemented with the use of audiovisual means and the introduction of some questions headed to the students, with the purpose of transmit knowledges and facilitate the learning. The student takes aim, poses doubts and questions. It can include a conference given by specialists or a technical visit to a particular chemical industry.
Problem solving	Methodology carried out in average group (20 students): presentation and resolution of numerical problems bulletins and of theory exercises bulletins. The student, of individual form or in reduced group, poses doubts and /or questions, participating of active form in the classroom.
Supervised projects	<p>It involves the realization, in small groups of 5 students, of directed studies that each group must expose in the classroom and deliver to the teacher for correction.</p> <p>The supervised projects will constitute a summary of the proposed subject by the teacher, with an extension in the order of 5-6 pages in Word format. For their presentation in the classroom, 8 to 10 transparencies in PowerPoint format will be prepared beforehand. The participants in each work must belong to the same average group of the class.</p> <p>All the groups that present a supervised Project in a determinate sesión, will have to be presents in the classroom from the beginning to the end of the same.</p>

Personalized attention	
Methodologies	Description



Problem solving Supervised projects Laboratory practice	<p>In the personalized attention will treat to amend possible deficiencies in the previous chemical training of the student and to resolve doubts and punctual questions that, usually, prevent him the general follow-up of the matter.</p> <p>It will realize a follow-up of the work of the student in the laboratory, will take in consideration his suggestions and will loan him help to clear the doubts.</p> <p>In the average group problem solving sessions, they will be helped to clarify concepts and resolve possible doubts.</p> <p>In the supervised projects preparation will facilitate them the assistance that require for his preparation and exhibition.</p> <p>The students that request and was them conceded academic dispense, will be able to remain exempt of the 80 % of the face-to-face classes assistance (Guest lecture and problems solving). They will realise mandatory the laboratory practices and will participate in the training of group of work sessions, preparation and presentation/exhibition of the supervised project, what involves the assistance to the 20 % of the face-to-face classes.</p>
---	---

Assessment			
Methodologies	Competencies	Description	Qualification
Mixed objective/subjective test	A4 B1 B2 B5	To half of 1st four-month period will realize an eliminatory partial examination of the matter given until this moment (theory and problems). At the end of the 1st four-month period will realise a final examination of all the subject (the students that have surpassed said partial will not have to repeat in the final examination).	70
Problem solving	A4 B2 B4 B5	Resolution of numerical problems bulletins, including likewise the resolution of theory exercises bulletins in specific sessions. It values the assistance of the student, his active participation in the classroom, his interest and attitude.	10
Supervised projects	A4 B6 B7 C1	Elaboration and presentation in group of a supervised or directed project. It values, in addition to the presentation, the realised work by the students in Word format and the elaborated transparencies for his exhibition in the classroom in PowerPoint format.	10
Laboratory practice	A4 B3 C5	Realization, practices active participation, delivery of the corresponding final report and the practices examination. The interest and attitude of the student and the practices examination is valued.	10

Assessment comments

This section indicates what marks in each methodology. The objective test describes as it is the examination and the punctuation of each one of the parts of theory and of problems. The minimum note in each part of the exam (theory or problems in the partial or final, or in the second part of the subject) so that you can take into account the scores of laboratory practices, problem solving and supervised work has to be 3.0 over 7.0. To obtain approved in the matter has to fulfil that the sum of the notes of the objective test, laboratory practice, problem solving of and supervised projects was at least 5.0.

Any of the theoretical subjects neither of the problems proposed in the partial examination will be able to leave in white, having to be recovered in the final examination with independence of the note obtained.

In order to be qualified, the student will perform all laboratory practice and participate in the elaboration and exhibition of the supervised work in this subject. These methodologies are mandatory. The students that do not approve the laboratory practice, will not be able to examine of the subject in the January and/or June announcements. Likewise, the students that have been missing to some practice and that present documentary justification of his fault, will have to do a practice pending examination during the last week of 1st four-month period.

To the student that surpass the subject first part (Inorganic and Analytical Chemistry) in the partial examination or in the announcement of January or, well, that surpass the subject second part (Industrial and Organic Chemistry) in the announcement of January, will save him the approved part note during the corresponding academic course. In case to repeat the subject will have to examine of the two parts again.

The student that have been missing to some practice of laboratory or that have not surpassed the examination of recovery of the practice, in case to repeat the matter has to go back to realize all again.

Will take into account, in the measure of the possible, the circumstances of the repeat students.

The students with enrolls to partial time will, or with academic dispense, have the same evaluation criteria that the other students, so much in the first as in the second opportunity of examination. Said students will have to realise the activities or compulsory methodologies (laboratory practice and supervised Project), in this case will remain exempt of 80% of the assistance to the face-to-face classes. Nevertheless, it recommends them that they do also the activity problem solving; in this case would remain exempt of 70% of the assistance to the face-to-face classes.

Sources of information

Basic	<ul style="list-style-type: none"> - BERMEJO, F.; PAZ, M.; BERMEJO, A.; PAZ, A. (1996). 1000 Problemas Resueltos de Química General y sus Fundamentos Teóricos. Madrid Paraninfo, S. A. - RECLAITIS, G. V. (1991). Balances de materia y energía. México. McGraw-Hill/Interamericana - QUIÑOÁ, E.; RIGUERA, R. (2004). Cuestiones y Ejercicios de Química Orgánica. Madrid. McGraw-Hill/Interamericana de España, S. A. U. - CHANG, R.; GOLDSBY, K. A. (2017). Química. México. McGraw-Hill/Interamericana Editores, S. A. de C. V. - VIAN, A. (1999). Introducción a la Química Industrial. Barcelona. Reverté, S. A. - SKOOG, D. A.; HOLLER, F. J.; NIEMAN, T. A. (2000). Principios de Análisis Instrumental. Madrid. McGraw-Hill/Interamericana de España, S. A. U. - LINSTROMBERG, W. W. (1979). Química Orgánica. Barcelona. Reverté, S.A. - PRIMO, E. (1994). Química Orgánica Básica y Aplicada. Barcelona. Reverté, S.A - PETER, K.; VOLLHARDT, C.; SCHORE, N. E. (2000). Química Orgánica. Estructura y función. Barcelona. Omega. - PETRUCCI, R. H.; HERRING, F. G.; MADURA, J. D.; BISSONNETTE, C. (2011). Química General. Principios y Aplicaciones Modernas . Madrid. Pearson Educación, S. A.
--------------	---



Complementary	<ul style="list-style-type: none"> - SOLOMON, T. W. G. (1999). Fundamentos de Química Orgánica. México. Limusa Noriega - LÓPEZ, J. A. (2000). Problemas de Química General. Cuestiones y Ejercicios. Madrid. Pearson Educación-Prentice Hall - BERMEJO, F.; BERMEJO, P.; BERMEJO, A. (1991). Química Analítica General, Cuantitativa e Instrumental. Madrid. Paraninfo, S. A. - COTTON, F. A.; WILKINSON, G. (1991). Química Inorgánica Básica. México. Limusa - VEGA, J. C. (2000). Química Orgánica para estudiantes de Ingeniería. México. Alfaomega. - WILLIS, C. J. (1993). Resolución de Problemas de Química General. Barcelona. Reverté, S. A. - SKOOG, D. A.; WEST, D. M.; HOLLER, F. J., CROUCH, S. R. (2005). Fundamentos de Química Analítica. Madrid. Thomson
----------------------	---

Recommendations

Subjects that it is recommended to have taken before

Subjects that are recommended to be taken simultaneously

Calculus /730G03001
 Engineering Drawing/730G03002
 Physics I /730G03003
 Computing/730G03004
 Linear Algebra/730G03006

Subjects that continue the syllabus

Materials Science/730G03007
 Thermodynamics /730G03014
 Environmental Engineering/730G03017
 Materials Engineering/730G03030

Other comments

Since it treats of a matter that gives in the 1st four-month period of first course of the career, is indispensable that the student handle with fluency concepts and basic knowledges of Mathematics, Physical and Chemistry of the high school diploma. Previously to study this matter considers of big importance to know the chemical nomenclature (that is to say, appoint and formulate the chemical elements and more common inorganic and organic compounds).

To help to achieve some immediate surroundings sustained and fulfil with the aim of the number 5 action: "Teaching and healthy and sustainable investigation environmental and social" of the "Green Campus Ferrol Action Plan":

1.- The delivery of the documentary works that realise in this matter:

- 1.1. They will request in virtual format and/or computer support.
- 1.2. Will realise through Moodle, in digital format without need to print them.
- 1.3. In case to realise them in paper:
 - They will not employ plastic.
 - Will realise impressions to double expensive.
 - Will employ paper recycled.
 - Will avoid the impression of drafts.

2.- It has to do a sustainable use of the resources and the negative impacts prevention on the natural half.

(*)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.