



Teaching Guide

Identifying Data					2013/14
Subject (*)	Ciencia de Materiais	Code	610G01035		
Study programme	Grao en Química				
Descriptors					
Cycle	Period	Year	Type	Credits	
Graduate	1st four-month period	Fourth	Obligatoria	6	
Language	SpanishGalicianEnglish				
Prerequisites					
Department	Química Fundamental				
Coordinador	Señaris Rodriguez, Maria Antonia	E-mail	m.senaris.rodriguez@udc.es		
Lecturers	Sanchez Andujar, Manuel Señaris Rodriguez, Maria Antonia	E-mail	m.andujar@udc.es m.senaris.rodriguez@udc.es		
Web					
General description	<p>- Español: Ciencia de Materiales es una materia obligatoria del primer semestre del cuarto curso del Grado en Química. Dicha asignatura pertenece al módulo de Formación complementaria en Química. Esta asignatura, de carácter claramente interdisciplinar está dedicada al estudio de los distintos tipos de materiales (metálicos, cerámicos, poliméricos, composites), sus propiedades (mecánicas, eléctricas, magnéticas, ópticas, etc.) y sus prestaciones.</p> <p>- English: Materials Science is a compulsory subject of the 7th semester (4th year, 1st semester) of our Degree in Chemistry, that belongs to the module "Complementary Formation in Chemistry". This subject, of marked interdisciplinary character, is devoted to the study of the different types of materials (metals, ceramics, polymers, composites), their properties (mechanical, electrical, magnetic, optical) and their performance.</p>				

Study programme competences

Code	Study programme competences
A1	Utilizar a terminoloxía química, nomenclatura, convenios e unidades.
A3	Coñecer as características dos diferentes estados da materia e as teorías empregadas para describilos.
A4	Coñecer os tipos principais de reacción química e as súas principais características asociadas.
A5	Comprender os principios da termodinámica e as súas aplicacións en Química.
A6	Coñecer os elementos químicos e os seus compostos, as súas formas de obtención, estrutura, propiedades e reactividade.
A7	Coñecer e aplicar as técnicas analíticas.
A9	Coñecer os rasgos estruturais dos compostos químicos, incluíndo a estereoquímica, así como as principais técnicas de investigación estrutural.
A10	Coñecer a cinética do cambio químico, incluíndo a catálise e os mecanismos de reacción.
A12	Relacionar as propiedades macroscópicas coas de átomos e moléculas.
A14	Demostrar o coñecemento e comprensión de conceptos, principios e teorías relacionadas coa Química.
A15	Recoñecer e analizar novos problemas e planear estratexias para solucionarlos.
A16	Adquirir, avaliar e utilizar os datos e información bibliográfica e técnica relacionada coa Química.
A17	Traballar no laboratorio Químico con seguridade (manexo de materiais e eliminación de residuos).
A18	Valorar os riscos no uso de sustancias químicas e procedementos de laboratorio.
A19	Levar a cabo procedementos estándares e manexar a instrumentación científica.
A20	Interpretar os datos procedentes de observacións e medidas no laboratorio.
A21	Comprender os aspectos cualitativos e cuantitativos dos problemas químicos.
A22	Planificar, deseñar e desenvolver proxectos e experimentos.
A23	Desenvolver unha actitude crítica de perfeccionamento na labor experimental.
A24	Explicar, de xeito comprensible, fenómenos e procesos relacionados coa Química.
A25	Relacionar a Química con outras disciplinas e recoñecer e valorar os procesos químicos na vida diaria.



A26	Levar a cabo procedementos estándares de laboratorios implicados en traballos analíticos e sintéticos, en relación con sistemas orgánicos e inorgánicos.
A28	Adquirir, avaliar e utilizar os principios básicos da actividade industrial, xestión e organización do traballo.
B1	Aprender a aprender.
B2	Resolver problemas de forma efectiva.
B3	Aplicar un pensamento crítico, lóxico e creativo.
B4	Traballar de forma autónoma con iniciativa.
B5	Traballar de forma colaborativa.
B6	Comportarse con ética e responsabilidade social como cidadán e como profesional.
B7	Comunicarse de maneira efectiva nun entorno de traballo.
C1	Expresarse correctamente, tanto de forma oral coma escrita, nas linguas oficiais da comunidade autónoma.
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.
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.
C5	Entender a importancia da cultura emprendedora e coñecer os medios ao alcance das persoas emprendedoras.
C6	Valorar criticamente o coñecemento, a tecnoloxía e a información dispoñible para resolver os problemas cos que deben enfrontarse.
C7	Asumir como profesional e cidadán a importancia da aprendizaxe ao longo da vida.
C8	Valorar a importancia que ten a investigación, a innovación e o desenvolvemento tecnolóxico no avance socioeconómico e cultural da sociedade.

Learning outcomes

Subject competencies (Learning outcomes)	Study programme competences		
To achieve a general vision of Materials Science and its interdisciplinary character . To achieve basic notions about different criteria for the classification of materials.	A15 A25	B1 B2 B3	C1 C3 C4 C5 C6 C7 C8
To know the different families of materials (metals, ceramics, polymers, composites) and the main methods of synthesis and processing To know their most outstanding properties and to be able to relate them to their composition, structure and microstructure.	A1 A5 A9 A10 A12 A15 A16 A21 A24 A25	B1 B2 B3	C1 C3 C4 C5 C6 C7 C8



To know the basics and applications of materials of interest for the electrical and electronic industries, and also of magnetic and optical materials.	A1 A3 A4 A5 A6 A9 A12 A14 A15 A16 A21 A24 A25	B1 B2 B6	C1 C3 C4 C5 C6 C7 C8
To develop criteria for the selection of materials based on their applications.	A14 A15 A21 A24 A25 A28	B1 B2 B3 B4 B5 B6 B7	C1 C3 C4 C5 C6 C7 C8
To get acquainted with techniques and working methodologies of common use in Materials Labs.	A1 A6 A7 A9 A10 A12 A16 A17 A18 A19 A20 A21 A22 A23 A24 A25 A26	B1 B2 B3 B4 B5 B6 B7	C1 C3 C4 C5 C6 C7 C8
To be able to analyze and interpret data containing scientific and technical information about materials.	A1 A15 A16	B1 B2 B3 B4 B6	C1 C3 C4 C5 C6

Contents	
Topic	Sub-topic
I. Introductory Section	? Introduction to Materials Science ? Criteria for classification of Materials ? Criteria for selection of Materials ? Mechanical tests and properties ? Structure, microstructure and phase diagrams



II. Families of Materials	? Metals and alloys (steels, cast irons and non-ferrous alloys) ? Ceramics (clay products, refractories, abrasives, cements, glasses, advanced ceramics) ? Polymers (thermoplastics, thermosetting polymers, elastomers) ? Composites ? Synthesis and processing techniques
III: Materials of technological interest	? Materials for the electrical and electronic industries: metals, semiconductors, superconductors, dielectrics, ferroelectrics, piezoelectrics, ionic conductors , etc. Devices. ? Magnetic materials: ferromagnetic, ferrimagnetic and antiferro-magnetic. Hard and soft magnetic materials. Main applications (motors, magnetic storage, etc.) ? Introduction to optical materials and their applications
IV: New trends in Materials Science and examples of selection of materials	? Biomaterials, nanomaterials, etc. ? Examples of selection of materials
V: Materials Laboratory	? Synthesis and processing ? Characterization and study of materials properties

Planning			
Methodologies / tests	Ordinary class hours	Student's personal work hours	Total hours
Guest lecture / keynote speech	25	62.5	87.5
Problem solving	5	12.5	17.5
Seminar	2	6	8
Events academic / information	1	2	3
Supervised projects	2	5	7
Laboratory practice	9	9	18
Mixed objective/subjective test	3	4.5	7.5
Personalized attention	1.5	0	1.5

(*):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 these lectures the teacher will present the contents of the different themes, emphasizing their main aspects and paying special attention to fundamental and/or difficult concepts.
Problem solving	These classes will be devoted to the resolution of a series of problems and questions that will be given in advance to the student so that he/she can work on them before the corresponding session.
Seminar	Work in small groups devoted to the discussion of a topic, a case study etc. prepared in advanced by the students.
Events academic / information	Complementary activities consisting in a visit to centers/installations working in aspects related to this subject, attendance to scientific talks organized by the Faculty and other organisms during this semester, etc. These activities will be organized and announced during the course depending on the number of students, the invited speakers that will come to the Faculty during this period, etc.
Supervised projects	Before starting the work in the Lab the students will have to carry out a study about aspects of interest for the topic of his/her experiment. This task will be guided and supervised by the teacher with whom the student will have at least one personal interview. Also, in the case of preparation of a case study or similar activity the students will have at least one tutoring session with the teacher that will orientate and supervise their work in progress
Laboratory practice	Supervised work that will be carried out in the Lab and that will be centered in the synthesis and processing of different types of materials, their characterization and study of their properties.



Mixed objective/subjective test	Final exam that will take place on the official dates approved by the "Junta de Facultad". It will evaluate the level of knowledge and competences acquired by the student and his/her capability to integrate them as well as proof a global vision on the subject.
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Personalized attention

Methodologies	Description
Guest lecture / keynote speech Seminar Events academic / information Laboratory practice Problem solving Supervised projects Mixed objective/subjective test	The personalized attention to students, understood as a support in the teaching-learning process, will take place in the sessions carried out with small groups and individual interviews. In addition, the student can ask for additional tutoring sessions that will take place during the tutoring hours of the teacher (whose timetable will be indicated at the beginning of the course)

Assessment

Methodologies	Description	Qualification
Guest lecture / keynote speech	Aspects that will be taken into account: extent of previous preparation, of follow-up and of active participation	0
Seminar	Aspects that will be taken into account: the work done by the students, their answers, their level of knowledge and their active participation in debates with the other students .	0
Events academic / information	Aspects that will be taken into account: the conclusions that the students have extracted from these activities and that they should also reflect in a written summary that they will have to present afterwards.	0
Laboratory practice	The work done in the lab will be assessed from the point of view of: organization and security, knowledge of material and techniques, working skills, and specially degree of understanding and rationalization of observed facts on a scientific basis. The previous preparation of this work and the laboratory notebook will be also taken into account in this evaluation. Although the grade will be based on a continuous evaluation, in particular cases the teacher can also carry out an exam.	0
Problem solving	Aspects that will be taken into account: the response of the students and their active participation in presential activities. Occasionally, and if requested by the teacher, the students should submit their answers to selected questions, that can also be evaluated.	0
Supervised projects	In the tutoring sessions associated to the activity "Trabajos tutelados" the teacher will not only guide the students but will also evaluate all aspects related to their preparation for the work in the Lab (in fact the student will not be allowed to start the work in the Lab until he/she have done a goodenough previous preparation), for the case studies , etc.	0
Mixed objective/subjective test	This final exam, that will take place at the end of the semester, can contain: questions to develop, short questions, a test and problems that will be similar to those solved during the Course.	0

Assessment comments



The final grade will result from the addition of the following partial contributions:

- Final exam ("Prueba mixta"): up to a maximum of 6 points.

-Activities carried out during the different sessions (seminars, exercises, tutoring sessions, scientific events, etc): up to a maximum of 2 points.

-Laboratory sessions: up to a maximum of 2 points.

To pass this subject a minimum of 5 points will be required, with the restriction that in the final exam ("prueba mixta") a minimum of 2.4 (over a maximum of 6) will be necessary as well as a minimum of 0.8 (over a maximum of 2) in the laboratory sessions. If these minima are not achieved the student will fail.

As the assessment of this subject is based on a continuous evaluation model, the progression of the student throughout the semester will be taken into consideration with a maximum of 1 point.

Also, and according to this evaluation model, if the student has participated in activities whose relative weight is more than a 25% of the total grade, he/she will be assessed. In this same context, and 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 carry out a final exam ("prueba mixta"). Nevertheless, and in very special cases, the teacher could also include a second part concerning aspects of the Laboratory Sessions.

This mark will be considered together with the others obtained during the course corresponding to the other activities (seminars, exercises, scientific events, etc.). The percentages of the different contributions will be the same as those of the former "first opportunity".

The highest grade "Matricula de Honor" will be mainly given to students that pass the subject in the "First Opportunity". And it will only be given in the so-called "second Opportunity" if there are still any available. In the case of very special and exceptional circumstances, adequately justified, the teacher can totally or partially exempt the student from the continuous evaluation process. This student will then have to go through an examination process where he/she will need to clearly prove his/her level of knowledge, competence, capabilities and skills.

Sources of information

Basic	
Complementary	

Recommendations

Subjects that it is recommended to have taken before

Subjects that are recommended to be taken simultaneously

Subjects that continue the syllabus

Química Inorgánica 1/610G01021

Química Inorgánica 2/610G01022

Química Inorgánica 3/610G01023

Química Inorgánica 4/610G01024

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.