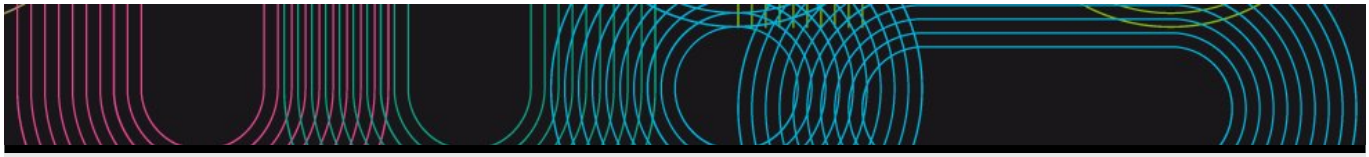

IDENTIFYING DATA				
Inorganic chemistry III				
Subject	Inorganic chemistry III			
Code	V11G200V01703			
Study programme	(*)Grao en Química			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	9	Mandatory	4th	1st
Teaching language	Spanish			
Department	Inorganic Chemistry			
Coordinator	Pérez Lourido, Paulo Antonio			
Lecturers	Bolaño García, Sandra Bravo Bernárdez, Jorge Carballo Rial, Rosa García Fontán, María Soledad Pérez Lourido, Paulo Antonio Valencia Matarranz, Laura María			
E-mail	paulo@uvigo.es			
Web				
General description	The first part of the subject centres in the structural study and the structure/properties relationship as well as the main methods of preparation of inorganic solids that represent an important contribution to the field of material science. The second part of the subject devotes to the study of the organometallic compounds. It will be developed the basic aspects referred to the obtaining, description of the bonding, spectroscopic characterisation, reactivity and applications of these compounds. In the laboratory will be realised experiences of synthesis and characterisation of coordination compounds, organometallic compounds and inorganic solids.			

Competencies	
Code	
A5	Students have developed those learning skills that are necessary for them to continue to undertake further study with a high degree of autonomy
C2	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories: types of chemical reactions and its main characteristics
C10	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories: properties of aliphatic, aromatic, heterocyclic and organometallic compounds
C12	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories: structural features of chemical elements and their compounds, including stereochemistry
C14	Demonstrate knowledge and understanding of essential facts, concepts, principles and theories: relationship between macroscopic properties and properties of individual atoms and molecules, including macromolecules
C20	Evaluate, interpret and synthesize data and chemical information
C23	Present oral and written scientific material and scientific arguments to a specialized audience
C25	Handle chemicals safely, considering their physical and chemical properties, including the evaluation of any specific risks associated with its use
C26	Perform common laboratory procedures and use instrumentation in synthetic and analytical work
C27	Monitor, by observation and measurement of physical and chemical properties, events or changes, and document and record them in a consistent and reliable way
C28	Interpret data derived from laboratory observations and measurements in terms of their significance and relate them to the appropriate theory
D1	Communicate orally and in writing in at least one of the official languages of the University
D3	Learn independently
D4	Search and manage information from different sources
D5	Use information and communication technologies and manage basic computer tools

D6	Use mathematics, including error analysis, estimates of orders of magnitude, correct use of units and data representations
D7	Apply theoretical knowledge in practice
D8	Teamwork
D9	Work independently
D12	Plan and manage time properly
D13	Make decisions
D14	Analyze and synthesize information and draw conclusions
D15	Evaluate critically and constructively the environment and oneself

Learning outcomes

Expected results from this subject		Training and Learning Results	
Recognise and predict the main structural types of solids and their implications in the chemical and physical properties.	A5	C12 C14	D1 D3 D4 D5 D9 D14
Enumerate and recognise the types of defects in crystals and their effects on the properties of the solid.	A5	C12 C14	D1 D3 D4 D5 D9 D14
(*)			
Define solid electrolytes, recognising their general characteristics and applications.		C2 C12 C14	D1 D3 D4 D14
Identify non-stoichiometric compounds.		C2 C12 C20	D1 D3 D4 D9 D14
Recognise the effect of the addition of impurities on the colour and the optical properties of some inorganic solids.	A5	C2 C12 C14 C20	D1 D3 D4 D9 D14
Identify the main methods of preparation of inorganic solids.		C2 C14 C20	D1 D3 D4 D14
Describe methodologies for crystallogenesis		C2	D1 D3 D4
Define organometallic compound . Describe the bonding between a metal and the different types of common ligands.		C10 C12 C14 C23	D1 D3 D4 D5 D9 D14
Rationalise the information that usual spectroscopyc techniques provide for the characterisation of the different types of organometallic compounds.		C10 C12 C14 C20 C23	D1 D3 D4 D5 D9 D14
Identify the main types of organometallic reactions .		C2 C10 C23	D1 D3 D4 D5 D14

Describe the products of the most important reactions of carbonyl, olefin, carbene and cyclopentadiene complexes.	C2 C10 C14 C20 C23	D1 D3 D4 D5 D9 D14
Describe the bases of the isolobal analogy. Apply the Wade's rules for metallic clusters.	C10 C12 C14 C20 C23	D1 D3 D4 D5 D9 D14
Describe some important catalytic cycles.	C2 C10 C14 C20 C23	D1 D3 D4 D5 D9 D14
Carry out in the laboratory the preparation, characterisation and the study of some physical and chemical properties of the metals and their compounds.	C2 C10 C14 C20 C25 C26 C27 C28	D4 D5 D6 D7 D8 D9 D12 D13 D14 D15

Contents	
Topic	
Subject 1. Organometallic chemistry of the main groups elements.	Introduction. Synthesis, properties and applications of the organometallic compounds of Li, Mg, B and Al.
Subject 2. Organometallic chemistry of the transition metals (I)	Introduction. Types of ligands. Bonding. Characterisation.
Subject 3. Organometallic chemistry of the transition metals (II)	Types of organometallic reactions: substitution, oxidative addition, reductive elimination, insertion, reactions of coordinated ligands, etc.
Subject 4. Organometallic chemistry of the transition metals (III)	Reactivity of organometallic compounds: carbonyl, olefin, carbene, and cyclopentadiene complexes.
Subject 5. Organometallic catalysis.	Introduction. Olefin metathesis. Alkene hydrogenation. Carbonylation of methanol. Hydroformylation of alkenes.
Subject 6. Metallic clusters	Introduction. Types. Structure. Properties.
Subject 7. Inorganic solids: introduction and bases.	Technological importance of the inorganic solids. Classification of solids. Polymorphism, pseudomorphism, polytypism. Formulation of inorganic solids incorporating structural information.
Subject 8. Structural rationalization in inorganic solids.	Sphere packing. Linear, planar, and theoretical densities and packing factors. Interstitial sites in crystal structures. Determining principles of the structure of the solids. Main solid structures.
Subject 9. Defects and no stoichiometry in the solids.	Types of defects. Ionic conductivity. Solid electrolytes. Non- stoichiometric compounds. Solids of different dimensionality. Diffusion.
Subject 10. Methods of preparation of solids.	Ceramic methods. Microwave methods. Sol-gel method. Precursor method. Hydrotermal methods. Chemical vapor deposition and chemical vapor transport (CVD and CVT), etc.
Practices of the chemistry of the coordination compounds (5 sessions)	Preparation and characterisation of some coordination compounds.
Practices of organometallic chemistry (4 sessions)	Preparation and characterisation of some organometallic compounds.
Practices of inorganic solids (4 sessions)	Preparation and study of the properties of some inorganic solids.

Planning			
	Class hours	Hours outside the classroom	Total hours
Seminars	13	42	55
Laboratory practices	45.5	20.5	66
Lecturing	26	50	76
Short answer tests	4	24	28

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

Methodologies	
	Description
Seminars	They will devote to the resolution of doubts or questions that arise in the development of each subject, to the exhibition by part of the students of any of the subjects related with the matter, and/or to the resolution of questions, exercises and problems proposed by the professor.
Laboratory practices	They will realise practices of laboratory in which they will apply the theoretical knowledges adquired. The practices will be realised in 13 sessions of 3,5 hours each and the students will have to reflect and interpret the facts observed in the corresponding notebook lab.
Lecturing	The students, in an only group, will receive 26 one-hour lectures in which the professor will give to know the most important aspects of each subject.

Personalized attention	
Methodologies	**Description**
Seminars	The students will be able to consult all type of doubts related with the matter in the scheduled tutorials.
Laboratory practices	The students will be able to consult all type of doubts related with the matter in the scheduled tutorials.

Assessment					
	Description	Qualification		Training and Learning	Results
Seminars	In addition to resolving practical exercises that allow the students to settle the knowledges on the subjects developed in the lectures, and to resolve all the exposed doubts, the classes of seminar will be used to carry out the students continuous evaluation. This process of continuous evaluation will be done through the resolution of exercises related with the contents of the matter as well as the resolution of short questions proposed by the professor. Also it will be able to carry out by means of the preparation and presentation by the students of subjects related with the subject.	30		C20 C23	D1 D3 D4 D5 D6 D7 D8 D9 D14
Laboratory practices	They are compulsory and will value the realisation of the practices of laboratory in which it refers so much to the fulfillment of the experimental aim foreseen how to the interpretation of the observed phenomena and the correct fulfillment of the laboratory notebook. It will be possible that the students have to do an examination.	25		C25 C26 C27 C28	D1 D3 D4 D5 D6 D7 D8 D9 D12 D13 D14 D15
Short answer tests	The students will realise two 2-hours written proofs.	45	A5	C2 C10 C12 C14 C20	D1 D14

Other comments on the Evaluation

Observations: The participation in any of the proofs of planned evaluation and the assistance to two or more sessions of laboratory will involve the condition of presented and, therefore, the allocation of a qualification in the record of the matter. It will be necessary to obtain a minimum of 4 points on 10 in the qualification of each one of the planned short proofs to be able to take into account, in the final qualification, the remaining elements of evaluation. In the evaluation of July the students will have to do a written proof that will consist of two parts that will correspond with the items evaluated in the two short proofs realised during the course. It will not be necessary to realise the part of the proof that, in the corresponding short proof, obtained an equal or upper qualification to 4 on 10, keeping the qualification obtained. This proof will have a value of 45% of the qualification and will substitute to the results of the short proofs. The remaining elements of evaluation are not recoverable and the qualifications obtained will add to the one of the quoted proof as long as the qualification obtained was equal or upper to 4 on 10. In case to obtain a lower qualification, will be this the one who appear as final qualification of the matter.

Sources of information

Basic Bibliography

C. E. Housecroft y A. G. Sharpe., **Inorganic Chemistry**, 4, Pearson, 2012

Complementary Bibliography

A. R. West, **Solid State Chemistry and its applications**, 2, Wiley, 2014

L. Smart, E. Moore, **Solid State Chemistry. An introduction**, 4, CRC, 2012

G. O. Spessard, G. L. Miessler, **Organometallic chemistry**, 2, Oxford University Press, 2010

R. H. Cabtree, **The organometallic chemistry of the transition metals**, 6, Wiley, 2014

Recommendations

Subjects that it is recommended to have taken before

Inorganic chemistry I/V11G200V01404

Organic chemistry I/V11G200V01304

Inorganic chemistry II/V11G200V01604

Organic chemistry II/V11G200V01504