Teaching Guide				
Identifying Data				2019/20
Subject (*)	Inorganic Chemistry 2		Code	610G01022
Study programme	Grao en Química			
Descriptors				
Cycle	Period	Year	Type	Credits
Graduate	2nd four-month period	Second	Obligatory	6
Language	SpanishGalicianEnglish			
Teaching method	Face-to-face			
Prerequisites				
Department	Química			
Coordinador	Lopez Torres, Margarita	E-mail	margarita.lopez.torres@udc.es	
Lecturers	Fernandez Lopez, Alberto A. Lopez Torres, Margarita Platas Iglesias, Carlos Vazquez Garcia, Digna	E-mail	alberto.fernandez@udc.es margarita.lopez.torres@udc.es carlos.platas.iglesias@udc.es d.vazquezg@udc.es	
Web	(En construcción)			
General description	Historically, the study of Chemistry has been divided in large areas of knowledge that included Inorganic Chemistry as one of them. This discipline includes experimental investigation and theoretical interpretation of the properties and reactivity of all elements of the periodic table as well as the compounds resulting from all of them. Therefore, two of the most characteristic features of Inorganic Chemistry are first the great diversity of contents and second its interdisciplinary nature. The significance of Inorganic Chemistry goes beyond the purely academic boundaries, as witnessed by the variety of inorganic products that are commonly used in our daily lives and the many examples of inorganic compounds with significant implications in industrial and technological processes that contribute decisively to the development of society. In the curriculum of the Degree in Chemistry of the UDC, and according to academic organisation criteria, Inorganic Chemistry introduced in the second year and organised in two theoretical-practical courses: Inorganic Chemistry 1 and Inorganic Chemistry 2. Inorganic Chemistry 2 focuses on the systematic study and synthesis of the elements of groups 13 and 14 and the metallic elements, as well as the study of the synthesis and properties of the compounds derived from these elements. From an academic point of view, this course settles the basis for the advanced Inorganic Chemistry courses and for the majority of other areas of knowledge.			

Study programme competences	
Code	Study programme competences
A1	Ability to use chemistry terminology, nomenclature, conventions and units
A2	Ability to describe and account for trends in properties of chemical elements throughout the periodic table
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
A6	Knowledge of chemical elements and their compounds, synthesis, structure, properties and reactivity
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
A17	Ability to work safely in a chemistry laboratory (handling of materials, disposal of waste)
A18	Risk management in relation to use of chemical substances and laboratory procedures
A20	Ability to interpret data resulting from laboratory observation and measurement
A21	Understanding of qualitative and quantitative aspects of chemical problems
A22	Ability to plan, design and develop projects and experiments
A23	Critical standards of excellence in experimental technique and analysis
A26	Ability to follow standard laboratory procedures in relation to analysis and synthesis of organic and inorganic systems

B1	Learning to learn
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)

Learning outcomes			
Learning outcomes	Study programme competences		
The student must know and rationalize the chemical behavior of the elements and their main compounds, as well as their individual properties and possibilities to be combined, using suitable models and theories and establishing relationships with their position in the periodic table.	A1 A2 A3 A4 A5 A6 A12 A14 A16 A21	B1 B3 B4	C1
The student must know the equipment and techniques of common use in a laboratory of Inorganic Chemistry, and develop the skills required to use them.	A17 A18 A20 A21 A22 A23 A26	B1 B2 B3 B4	C1
The student must be able to relate critically the theoretical knowledge with the experimental facts observed in the laboratory.	A14 A20	B1 B3 B4	C1
The student must know the bibliographic resources used in Inorganic Chemistry.	A16	B1 B3 B4	C1

Contents	
Topic	Sub-topic
Lesson 1. Metals: an overview.	1.1. General Characteristics of metals. 1.2. Structure and bonding. 1.3. Physical and chemical properties. Química en disolución acuosa. Aqueous solution chemistry. Aquated cations: formation and acidic properties. Pourbaix diagrams. 1.4. Obtaining. Ellingham diagrams.
Lesson 2. Coordination Chemistry.	2.1. General considerations: Definición and terminology. 2.2. Types of ligands. 2.3. Bonding in complexes. 2.4. Coordination numbers and geometries. 2.5. Isomerism in coordination chemistry. 2.6. Ligand Topology.

Lesson 3. The Group 14 elements (C, Si, Ge, Sn, Pb).	3.1. Electronic structures of atoms and chemical behavour. 3.2. The elements: structure and bonding, physical and chemical properties. Aqueous solution chemistry. 3.3. Occurrence, extraction and uses. 3.4. Main compounds.
Lesson 4. The Group 13 elements (B, Al, Ga, In, Tl).	4.1. Electronic structures of atoms and chemical behavour. 4.2. The elements: structure and bonding, physical and chemical properties. Aqueous solution chemistry. 4.3. Occurrence, extraction and uses. 4.4. Main compounds.
Lesson 5. The Groups 1, 2 and 3.	5.1. Electronic structures of atoms and chemical behavour. Diagonal relationships between Li and Mg, and between Be and Al. 5.2. The elements: structure and bonding, physical and chemical properties. Aqueous solution chemistry. 5.3. Occurrence, extraction and uses. 5.4. Main compounds.
Lesson 6. d-Block metal chemistry: the first row metals.	6.1. The d-Block metals: General characteristics and classification. 6.2. Electronic structures of atoms and chemical behavour. The most common oxidation states. 6.3. The elements: structure and bonding, physical and chemical properties. Aqueous solution chemistry. 6.4. Occurrence, extraction and uses. 6.5. Main compounds.
Lesson 7. d-Block metal chemistry: the second and the third row metals.	7.1. Electronic structures of atoms and chemical behavour. The most common oxidation states. 7.2. The elements: structure and bonding, physical and chemical properties. Aqueous solution chemistry. 7.3. Occurrence, extraction and uses. 7.4. Main compounds.
Lesson 8. The f-block metals.	8.1. Lanthanides 8.2. Actinides 8.3 Postactinides
Lesson 9. Experimental Inorganic Chemistry.	Synthesis of inorganic elements and compounds.

Planning				
Methodologies / tests	Competencies	Ordinary class hours	Student?s personal work hours	Total hours
Introductory activities		2	0	2
Guest lecture / keynote speech	A1 A2 A3 A4 A5 A6 A12 A14 A21 B2 C1	22	44	66
Problem solving	A1 A2 A3 A4 A5 A6 A12 A14 A21 B2 B4 C1	8	24	32
Supervised projects	A14 A16 A21 B1 B2 B3 B4 C1	1	15	16
Laboratory practice	A14 A17 A18 A20 A21 A22 A23 A26 B1 B2 B3 B4 C1	18	0	18

Objective test	A1 A2 A3 A4 A5 A6 A12 A14 A21 B2 B3 C1	1	0	1
Mixed objective/subjective test	A1 A2 A3 A4 A5 A6 A12 A14 A21 B2 B3 C1	4	10	14
Personalized attention		1	0	1
(*)The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.				

Methodologies	
Methodologies	**Description**
Introductory activities	Presentation of the course and its contents, the methodology that is used throughout the course and the criteria that will be used for the assessment.
Guest lecture / keynote speech	Classroom activity designed for relatively large groups of students (a maximum of sixty) in which to present the main contents of the course. The lectures will require the participation of the students asking questions about the lecture and answering those questions raised by the instructor. It is advised that the students read in advance the literature associated to the topic that will be covered by the lecture. In some cases, the students will prepare some topics that will not be covered in the lectures.
Problem solving	On site activities for small to very small groups in which the students must participate actively. A list of problems and exercises will be delivered to the students before the problem solving sessions. The problems are discussed and solved by the students following the guidance of the instructor.
Supervised projects	Before starting the laboratory practice the student will perform an initial survey of theoretical and preparative aspects related to the experiment that will be carried out in the laboratory. For this purpose, students will make use of the knowledge of the contents of the course and the sources of information recommended by the instructor. This preliminary work and the conclusions drawn from the study will be presented to the instructor in an interview before the laboratory practice starts. The instructor will assess whether the student has gained enough knowledge to start the experiments in the laboratory with safety and with ability to link the experiments with the concepts delivered during the course.
Laboratory practice	It will focus on the synthesis and isolation of inorganic substances. The experiments must be carried out with a careful observation of the safety rules, as well as with the efficiency and rigor characteristic of the scientific method. The students will complete a laboratory notebook that will contain three different parts: An overview of the preliminary work developed to prepare the experiment (supervised projects), a detailed description of the execution of the experiment (laboratory diary), and a comment on the results obtained and the conclusions that can be drawn from the experiments.
Objective test	The students will solve tests with short questions in some of the sessions scheduled for lectures or problem solving activities. This will aid both students and instructors to detect deficiencies related to the contents of the course presented up to that point.
Mixed objective/subjective test	Written text that will contain different types of exercises: - Essay-type questions that require medium or long answers that address a rather general topic - Short answer questions to address more specific issues. - Problem-solving questions, which require calculations for their solution or the logical application of the competences that the student has acquired during the course. - Multiple-choice questions.

Personalized attention	
Methodologies	**Description**

Guest lecture / keynote speech Problem solving Laboratory practice Mixed objective/subjective test Supervised projects Objective test	The teaching-learning process is supported by individual attention to the student, and will take place at the most convenient time for the student and the teacher. Those students having a part-time dedication to the course, and thus waiver of assistance to the on site academic activities according to the regulations of UDC, will be supported with specific individual attention in different forms: - Tutoring support upon request of the student. - The instructor will propose (upon student request) specific tasks to the student such as problem sheets related to the contents of the course. The student will solve the problems individually and then request a tutoring session to have convenient feedback from the instructor. - Tutoring support for the preparation of the experiments that the student will carry out in the laboratory and the preparation of the personal interview (see methodologies above). Again these tutoring sessions will take place upon student request and scheduled at the convenience of the student.

Assessment			
Methodologies	Competencies	Description	**Qualification**
Problem solving	A1 A2 A3 A4 A5 A6 A12 A14 A21 B2 B4 C1	During the problem-solving classes, the professor assesses the solution of the proposed problems as well as their active participation in the discussions with the other students.	10
Laboratory practice	A14 A17 A18 A20 A21 A22 A23 A26 B1 B2 B3 B4 C1	Work in the laboratory will be assess according to: - Organization and security - Knowledge of the material and technical procedures - manual skill and, especially, the ability to understand the processes observed from the previous preparation. The laboratory notebook will also be marked, consisting of three parts: 1-Summary of the previous theoretical preparation (carried out during the supervised work). 2-Detailed description of laboratory work (laboratory diary). 3- Results and conclusions drawn from the experiment.	20
Mixed objective/subjective test	A1 A2 A3 A4 A5 A6 A12 A14 A21 B2 B3 C1	Students will take the mixed test in the hours designed by the Faculty. It will consist of a number of questions and problems related to the subject's contents.	50
Supervised projects	A14 A16 A21 B1 B2 B3 B4 C1	During the interview associated to the supervised work, the teacher will assess whether the student has gained enough knowledge of theoretical and preparative aspects related to the experiment that will be carried out in the laboratory The student will not be able to begin the work in the laboratory until he/she performs adequately this previous preparation.	10
Objective test	A1 A2 A3 A4 A5 A6 A12 A14 A21 B2 B3 C1	Periodically, the students will perform a series of short-term or short-answer tests, in accordance with the section of methodologies	10

Assessment comments

Passing the course requires: 1) Obtaining a grade of 5 points (out of a maximum score of 10); 2) Gaining a minimum of 5.0 points in the mixed objective/subjective test (exam); and 3) Obtaining a minimum of 4.0 points summing the grades obtained for the Supervised Project and Laboratory Practice. In case that the student does not obtain the minimum points in some of these items, but the sum of the points is equal or higher than 5.0, the overall grade will correspond to 4.5 points.
Given that this course follows a continuous-assessment model, the progress of the student during the semester can be granted with up to 1.0 additional(extra) points.
Attending the laboratory practice is compulsory to pass the course.
A student will not be graded when participating in activities counting less than 25% of the overall grade.
The students that do not pass the course in the first chance have a second opportunity in July to have a mixed test. The maximum score of the second tests 5 points, the remaining 50% of the overall grade being the result of the assessment of the other activities of the course. In other words, the grade obtained in the second mixed test (July) replaces that obtained in the firsttest (June), while the remaining part of the grade does not change. For the second opportunity those students who have failed laboratory practice may complete the laboratory notebook in those aspects related to theoretical preparation, calculations, calculation of yield and analysis of the results, to improve their marks.
Students assessed in the second opportunity can only be granted with a"Matrícula de Honra" (the highest grade awarded to outstanding students) only if the maximum number of these distinctions according to the regulations were not awarded to students passing the course in the first opportunity.
Those students having a part-time dedication to the course, and thus waiverof assistance to the on-site academic activities according to the regulations of UDC, must attend the supervised projects and laboratory practice (compulsory). The final grade for these students will be the result of the following breakdown: 30% of the overall grade corresponds to the assessment of the laboratory work and supervised projects and the remaining 70% to the assessment of the mixed test. This breakdown is applied both for the first(June) and second (July) chances.
Only in very exceptional circumstances (adequately justified) the student may be exempted from the continuum evaluation process. In that case, he must pass a special examination to prove, without any doubt, the overall level of knowledge and skills.

Sources of information	
Basic	- E.C. Housecroft y A.G. Sharpe (2006). Química Inorgánica. Madrid, Pearson 2ª Ed. (en inglés 4ª Ed 2012) - D.F. Shriver, P.W. Atkins, T.L. Overton, J.P. Rourke, H.T. Weller y F.A. Armstrong (2008). Química Inorgánica. México, McGraw-Hill 4ª Ed. (en inglés 6ª Ed. 2014) Bibliográfía de Prácticas: G. Brauer. "Preparative Inorganic Chemistry", vols. I y II. Academic Press, Nueva York (1963 y 1965). Versión en castellano de la 2ª ed. alemana: "Química Inorgánica Preparativa", Reverté, Barcelona (1958) G.C. Schlessinger. "Inorganic Laboratory Preparations". Chemical Pub. Co., Nueva York (1962). Versión en castellano: "Preparaciones de Compuestos Inorgánicos en el Laboratorio", Continental, México (1962) Z. Szafran, R.M. Pike y M. Singh. "Microscale Inorganic Chemistry: A Comprensive Laboratory Experience". Wiley & Sons, Nueva York (1991)
Complementary	- E. Gutiérrez Ríos (1984). Química Inorgánica . Barcelona, Reverté 2ª Ed. - S.M. Owen y A.T. Brooken (1991). A Guide to Modern Inorganic Chemistry. Harlow. Longman - J.D. Lee (1996). Concise Inorganic Chemistry. London, Chapman&Hall 6th Ed. - N.N. Greenwood y A. Earnshaw (1997). The Chemistry of the Elements. Oxford, Butterworth Heinemann 2nd Ed. - G.E. Rodgers (2002). Descriptive Inorganic Coordination and Solid State Chemistry . Melbourne, Thomson Learning 2ª Ed. [en castellano: 1ª Ed., 1995] - G. Rayner-Canham y T. Overton (2000). Química Inorgánica Descriptiva. Mexico, Pearson, 2ª Ed. [en inglés: 6ª Ed., 20014] - F.A. Cotton, G. Wilkinson, C.A. Murillo y M. Bochman (1999). Advanced Inorganic Chemistry. New York, Wiley&Sons 6th Ed. [en castellano: 4ª Ed., 1986] Bibliografía de teoría e prácticas de laboratorio enfocada cara á Química Inorgánica en xeral, a disposición pública na Biblioteca da Facultade de Ciencias.

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
Inorganic Chemistry 1/610G01021
Subjects that continue the syllabus
Inorganic Chemistry 3/610G01023 Inorganic Chemistry 4/610G01024 Advanced Inorganic Chemistry/610G01025 Industrial Chemistry/610G01039
Other comments
Como complemento ás clases presenciais e ao material bibliográfico porase á disposición do alumno (mediante os medios establecidos en cada caso) a documentación relativa aos contidos das sesións maxistrais, boletíns de exercicios e problemas, documentos guía para as prácticas de laboratorio e/ou cuestionarios de diversa natureza.NOTA: Aconséllase a asistencia a todas as clases, así como a participación activa en todas as actividades.