UNIVERSIDADE DA CORUÑA

Teaching Guide				
Identifying Data				2020/21
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	Vazquez Garcia, Digna		E-mail	d.vazquezg@udc.es
Lecturers	Fernandez Lopez, Alberto A. Lopez Torres, Margarita Martínez Calvo, Miguel Platas Iglesias, Carlos Vazquez Garcia, Digna		E-mail	alberto.fernandez@udc.es margarita.lopez.torres@udc.es miguel.martinez.calvo@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 which included Inorganic Chemistry among 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 derived from them. Therefore, two of the most characteristic features of Inorganic Chemistry are in first place, the great diversity of contents and second, its interdisciplinary nature. The significance of Inorganic Chemistry goes beyond of purely academic boundaries. Thus, in our daily lives, we can find a great variety of inorganic products which are commonly used. It can be remarked the significant implications in industrial and technological processes which contribute decisively to the development of society. In the curriculum of the Degree in Chemistry of the UDC and according to academic organization criteria, Inorganic Chemistry is scheduled in the second year of the Degree and planned 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.			
Contingency plan	1. Modifications to the contents. In the case of this course there are no modifications in the contents. 2. Methodologies *Teaching methodologies that are maintained. All teaching methodologies are maintained. Those activities that were carried out face to face, will be carried out virtually on the work platforms used by the UDC. In the event that part of the students cannot continue with face-to-face teaching, asynchronous means will be used (email, recordings of the exhibition sessions, specific multimedia material ...) *Teaching methodologies that are modified. In the case of this course there are no modifications. 3. Mechanisms for personalized attention to students. Tutorial support will be provided when required by the students, through the use of online tools such as the Microsoft Teams Platform, institutional email from UDC or Moodle. 4. Modifications in the evaluation. - The evaluation will be carried out using platforms such as Moodle, Office 365 package tools and / or applications available on the Internet. - All the evaluable activities and their weight in their qualification do not vary. *Evaluation observations: 5. Modifications to the bibliography or webgraphy. In the case of this course there are no modifications in the contents.			

Study programme competences / results	
Code	Study programme competences / results
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 / results		
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. Chemistry in aqueous solution. Aquated cations: formation and acidic properties. Pourbaix diagrams. 1.4. Preparation. Ellingham diagrams.
Lesson 2. Coordination Chemistry.	2.1. General considerations: Definition 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 behaviour. 3.2. The elements: structure and bonding, physical and chemical properties. Chemistry in aqueous solution. 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 behaviour. 4.2. The elements: structure and bonding, physical and chemical properties. Chemistry in aqueous solution. 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 behaviour. Diagonal relationships between Li and Mg, and between Be and Al. 5.2. The elements: structure and bonding, physical and chemical properties. Chemistry in aqueous solution. 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 behaviour. The most common oxidation states. 6.3. The elements: structure and bonding, physical and chemical properties. Chemistry in aqueous solution. 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 behaviour. The most common oxidation states. 7.2. The elements: structure and bonding, physical and chemical properties. Chemistry in aqueous solution. 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 / Results	Teaching hours (in-person & virtual)	Student?s personal work hours	Total hours
Introductory activities	B1	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	20	28
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
Multiple-choice questions	A1 A2 A3 A4 A5 A6 A12 A14 A21 B2 B3 C1	0	1	1
Document analysis	A1 A2 A3 A4 A5 A6 A12 A14 A21 B2 B3 C1	0	5	5
Mixed objective/subjective test	A1 A2 A3 A4 A5 A6 A12 A14 A21 B2 B3 C1	4	8	12
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 subject 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 the main contents of the course are presented. 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.
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. Before attending class, and in order to participate and be evaluated in it, the student must submit the exercises through the online platform available for the course. 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 answer intermediate tests with short questions combining multiple-choice answer questions, organization, short-answer, discrimination and/or association questions, in some of the sessions scheduled for lectures or problem solving activities. This will help both students and instructors to detect deficiencies related to the contents of the course presented up to that point.
Multiple-choice questions	A test will be carried out in the lectures at the end of each lesson, to evaluate the learning of the contents. This test will be made using platforms such as Moodle, Office 365 package tools and / or applications available on the Internet. For this purpose, questions will be asked as a direct question or an incomplete statement, and several options or response alternatives providing possible solutions, of which only one of them is valid, thus seeing the degree of assimilation of the contents of the course by the student.
Document analysis	This methodology will help the student to work on relevant content for the subject matter, with activities specifically designed on the platforms for their analysis through the use of audiovisual and / or bibliographic documents (fragments of documentary reports or films, current news, photographs, articles, etc.) available to the student through the online platforms.
Mixed objective/subjective test	Written test 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, and Multiple-choice questions.

Personalized attention	
Methodologies	**Description**
Guest lecture / keynote speech Problem solving Laboratory practice Mixed objective/subjective test Supervised projects Objective test Multiple-choice questions Document analysis	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 / Results**	**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 three parts of the laboratory notebook will also be graded: 1-Summary of the 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, according to the Methodology section.	40
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 the 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 take a series of short-term or short-answer tests, in accordance with the methodologies section.	10
Multiple-choice questions	A1 A2 A3 A4 A5 A6 A12 A14 A21 B2 B3 C1	Periodically, short multiple-choice tests will be carried out through online platforms, according to what is indicated in the Methodology section.	5
Document analysis	A1 A2 A3 A4 A5 A6 A12 A14 A21 B2 B3 C1	Periodically, according to what is indicated in the methodology section, there will be activities in which, based on audiovisual and / or bibliographic documents, the student must answer questions related to the content through the online platforms available for the course.	5

Assessment comments

Passing the course requires obtaining a minimun of 50 points. It is also mandatory to achieve at the same time a minimum of the 50 % of the grade of the mixed test and also a minimum of 40 % of the sum of the marks from Tutorized works + Laboratory practice. In the case of a student who do not get the minimum mark in any of them, even if the sum of the global is equal or higher than 50, the course will be considered failed (4.5 over 10 points). The evaluation cannot be positive if not all laboratory classes have been attended. The student will not be graded when participating in activities that add up to less than 25% of the final grade of the continuous assessment. Regarding the second chance in July: The grade of the mixed test of the second oportunity will replace that obtained in the mixed test of the first opportunity, being again necessary to obtain a minimum of 5 (out of 10) of the total score of the mixed test in order to pass the subject, which will mean, as in "the first opportunity", 40% of the grade. Those students who failed to pass the laboratory practice will be able to carry out a supervised project regarding a new laboratory practice and the corrresponding summary of the theoretical preparation. The qualification of the rest of evaluable activities during the course will be kept in the second opportunity in July.

Students who are assessed in the "second chance" will only be eligible for honors if the maximum number of these for the course, in accordance with academic regulations, was not fully covered in the "first chance".

Those students who take advantage of the "recognition of part-time dedication and academic exemption from attendance" in accordance with UDC regulations, will only be required to attend supervised work and practical laboratory classes. The final grade for these students will consist of two parts: the grade obtained in the supervised work and laboratory practices, which will contribute 30% to the final grade and the mixed test, which will count for the remaining 70%. These qualification percentages will apply to both opportunities.

In the case of exceptional, objectifiable and duly justified circumstances, the Responsible Professor may totally or partially exempt any member of the student body from participating in the continuous assessment process. Students who find themselves in this circumstance must pass a specific exam that leaves no doubt about the achievement of the competencies of the subject.

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
As a complement to the face-to-face classes and the bibliographic material, instructors will make available for the students (through the means established in each case) the documentation related to the master sessions, exercise and problem sheets, guidance documents for laboratory practices and / or questionnaires of various kinds. Note: Attendance to all classes is advised, as well as active participation in all activities.