VNIVERSITAT DE VALÈNCIA

Course Guide
36452 Inorganic Chemistry I

COURSE DATA

Data Subject	
Code	36452
Name	Inorganic Chemistry I
Cycle	Grade
ECTS Credits	6.0
Academic year	2020 - 2021

Study (s)

Degree	Center	Acad. year	Period
1110 - Degree in Chemistry	Faculty of Chemistry	2	First term

Subject-matter

Degree	Subject-matter	Character
1110 - Degree in Chemistry	8 - Inorganic Chemistry	Obligatory

Coordination

Name	Department
GOMEZ GARCIA, CARLOS JOSE	320 - Inorganic Chemistry

SUMMARY

One of the most complete definitions of Inorganic Chemistry is provided by T. Moeller, which defines this discipline as one that deals with the experimental research and theoretical interpretation of the properties and reactions of all the elements and all its compounds except for hydrocarbons and most of its derivatives. There are other definitions which, like the of J. E. Huheey, a priori may seem funny and/or lacking sense. This author, defines the Inorganic Chemistry as any area of the chemistry of interest for inorganic chemist. Although this definition apparently adds little to the understanding of the content of this discipline, is very interesting because today highlights the two most characteristic features of inorganic chemistry: (i) its great diversity and (ii) its interdisciplinary nature. Its study covers the behaviour of more than 100 elements, with thousands of compounds with very different properties, which is one of the most attractive characteristics: locate such a large number of facts in a similarly diverse. Its relevance gives an idea of this discipline goes beyond the purely academic limits and is an important part of life as we know it; just think of the fact that the enzymes, catalysts of biological processes, are made up of whose activity is essentially regulated by the metal ion coordination. In another order of things in our everyday life, there are plenty of inorganic products that greatly facilitate us.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

This subject is related to the two first year subjects General Chemistry I and II since in these subjects some basic thermodynamic, structural, bonding, acid-base and redox principles that were already introduced in the General Chemistry subjects.
It is recommended that all students enrolled in this course have completed and passed the subjects previously General Chemistry I and General Chemistry II.
The subject Inorganic Chemistry II completes this subject by studying the metallic elements of the peri

OUTCOMES

1110 - Degree in Chemistry

- Develop capacity for analysis, synthesis and critical thinking.
- Show inductive and deductive reasoning ability.
- Solve problems effectively.
- Demonstrate ability to work in teams both in interdisciplinary teams and in an international context.
- Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using information technology, as appropriate.
- Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional.
- Demonstrate the ability to adapt to new situations.
- Demonstrate knowledge of the main aspects of chemical terminology, nomenclature, conventions and units.
- Interpret the variation of the characteristic properties of chemical elements according to the periodic table.
- Demonstrate knowledge of the main types of chemical reaction and their main characteristics.
- Demonstrate knowledge of the principles of thermodynamics and kinetics and their applications in chemistry.
- Ability to recognise chemical elements and their compounds: preparation, structure, reactivity, properties and applications.
- Demonstrate knowledge of the principles, procedures and techniques for the determination, separation, identification and characterisation of chemical compounds.

- Solve qualitative and quantitative problems following previously developed models.
- Recognise and analyse new problems and plan strategies to solve them.
- Evaluate, interpret and synthesise chemical data and information.
- Interpret data from observations and measurements in the laboratory in terms of their significance and the theories that underpin them.
- Relate theory and experimentation.
- Understand the qualitative and quantitative aspects of chemical problems.
- Develop sustainable and environmentally friendly methods.
- Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.

LEARNING OUTCOMES

The previous section includes the competences contained in the document VERIFICA. This subject addresses part of the learning results of the matter Inorganic Chemistry that allow to acquirespecific knowledge of chemistry, cognitive skills and general skills recommended by the EUROPEAN CHEMISTRY THEMATIC NETWORK (ECTN) for the Chemistry Eurobachelor® Label. The following table lists the learning outcomes acquired in the subject Inorganic Chemistry I related to the competences of the degree in Chemistry.

SPECIFIC KNOWLEDGE OF CHEMISTRY	
The learning process should allow the degree graduates to demonstrate:	
	Competencias de la asignatura Química Inorgánica I que contemplan los resultados de aprendizaje EUROBACHELOR®
Major aspects of chemical terminology, nomenclature, conventions and units.	Demonstrate knowledge of the main aspects of chemical terminology, nomenclature, conventions and units..(CE1)
The major types of chemical reaction and the main characteristics associated with them.	Demonstrate knowledge of the main types of chemical reaction and their main characteristics.(CE4)

The principles of thermodynamics and their applications to chemistry	Demonstrate knowledge of the principles of thermodynamics and kinetics and their applications in chemistry..(CE6).
The characteristic properties of elements and their compounds, including group relationships and trends within the Periodic Table	Interpret the variation of the characteristic properties of chemical elements according to the periodic table..(CE2). Ability to recognise chemical elements and their compounds: preparation, structure, reactivity, properties and applications..(CE7).
The structural features of chemical elements and their compounds, including stereochemistry.	Ability to recognise chemical elements and their compounds: preparation, structure, reactivity, properties and applications..(CE7). Relate the macroscopic properties and the properties of individual atoms and molecules, including macromolecules (natural and synthetic), polymers, colloids and other materials.CE11). Show knowledge of the structure and reactivity of the main classes of biomolecules and the chemistry of the main biological processes..(CE12).
The relation between bulk properties and the properties of individual atoms and molecules, including macromolecules (both natural and man-made), polymers and other related materials.	Relate the macroscopic properties and the properties of individual atoms and molecules, including macromolecules (natural and synthetic), polymers, colloids and other materials.CE11).
COMPETENCES AND COGNITIVE SKILLS	
The learning process should allow the degree graduates to demonstrate:	
	Competences of the subject Inorganic Chemistry I that contemplate the learning outcomes EUROBACHELOR®
Ability to demonstrate knowledge and	Demonstrate knowledge and understanding of

understanding of the facts, concepts, principles and fundamental theories related to the topics mentioned above.	essential facts, concepts, principles and theories related to the areas of chemistry..(CE13).
Competences for the evaluation, interpretation and synthesis of information and chemical data.	Evaluate, interpret and synthesise chemical data and information..(CE16). Interpret data from observations and measurements in the laboratory in terms of their significance and the theories that underpin them..(CE20).
Competences to present and argue scientific issues orally and in writing to a specialized audience.	Relate chemistry with other disciplines.(CE26). Prepare reports, surveys and industrial and environmental projects in the field of chemistry..(CE27). Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using information technology, as appropriate. (CG6). Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences..(CB4).
Competences to present and argue scientific issues orally and in writing to a specialized audience.	Relate chemistry with other disciplines.(CE26). Prepare reports, surveys and industrial and environmental projects in the field of chemistry..(CE27).
GENERAL COMPETENCES	
The learning process should allow the degree graduates to demonstrate:	
	Competences of the subject Inorganic Chemistry I that contemplate the learning outcomes EUROBACHELOR®
Ability to apply practical knowledge to solve problems related to qualitative and	Solve problems effectively..(CG4).

quantitative information.	Solve qualitative and quantitative problems following previously developed models..(CE14). Relate theory and experimentation..(CE22). Recognise and evaluate chemical processes in daily life..(CE23). Understand the qualitative and quantitative aspects of chemical problems..(CE24).
Calculation and arithmetic capabilities, including aspects such as analysis error, estimates of orders of magnitude, and correct use of the units.	Develop capacity for analysis, synthesis and critical thinking.. (CG1). Show inductive and deductive reasoning ability..(CG2). Solve problems effectively..CG4). Demonstrate ability to work in teams both in interdisciplinary teams and in an international context.(CG5).
Interpersonal skills to interact with other people and get involved in team work.	Demonstrate ability to work in teams both in interdisciplinary teams and in an international context.(CG5). Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional. (CG7) Demonstrate the ability to adapt to new situations..(CG9).

DESCRIPTION OF CONTENTS

1. Concept of Inorganic chemistry

Concept of inorganic chemistry. Introduction to inorganic chemistry. Presentation of the periodic table. Source and abundance of the chemical elements.

2. Review of basic concepts

Review of basic structural concepts. Types of compounds: classification by the type of link and structural. Main types of structures of non-molecular compounds.
Review of basic thermodynamic concepts. Binding energy. Lattice energy. Thermodynamic cycles for the analysis of the stability of molecular substances and Ionic compounds.
Review of concepts of solubility. Thermodynamic cycles for the analysis of the phenomenon of the solubility of ionic salts in water.

3. Acid-base and redox reactions

Reactions acid-base and redox. Acid-base concepts. The solvent system. Hard and soft acids. Orbital border in acid-base reactions. Reduction potential. Kinetic factors. Redox stability in water. Latimer and Frost diagrams.

4. Hydrogen

Hydrogen. Isotopes. Obtention of hydrogen, reactivity and applications. Hydrides: Classification, structure, bond and reactivity. Hydrogen bond. Hydrogen as an energy vector.

5. Group 18: Noble gases

Group 18: Noble Gases. General characteristics of the group. Obtention and application of the noble gases. Main compounds of noble gases

6. Group 17: Halogens

Group 17: halogens. General characteristics of the group. Singularity of F. Obtention and application of the elements. Halides. Oxo acids and oxosals. Interhalogen compounds and pseudohalogens. Biological aspects of the elements of the Group

7. Group 16: Chalcogens

Group 16: Chalcogens. General characteristics of the group. Electronic structure of the dioxygen and its reactivity. Ozone: structure, reactivity and environmental importance: ozone and photochemical smog. Oxides: structure and acid-base behavior. Water. Hydrogen peroxide. Sulphur: concatenation, allotropy, and reactivity. Sulphides, halides, oxides, oxo acids of sulphur oxosals. Preparation of sulfuric acid. Chemistry of selenium and tellurium. Biological aspects of the elements of the group.

8. Group 15: N, P, As, Sb

Group 15: N, P, As, Sb. General characteristics of the group. Uniqueness of the b. obtaining and application of the elements. The inert pair effect. Electronic structure of the dinitrogen molecule and its reactivity. Oxidation of nitrogen, chemical redox States. Hydrides, oxides, oxo acids and nitrogen oxosals. Acid rain. Preparation of nitric acid. Allotropy and reactivity of phosphorus. Oxides, oxo acids and oxosals. Phosphate esters. Chemistry of arsenic and antimony. Biological aspects of the elements of the group.

9. Group 14. C, Si and Ge

Group 14. C, Si and Ge. General characteristics of the group. Singularity of C. Preparation and application of the elements. Allotropy of carbon and reactivity. Catenation. Oxides of carbon. Greenhouse effect and global warming. Carbon dioxide and carbonates. Halides of carbon: CFCs and substitutes. Cyanides. Silicon dioxide. Structural diversity of silicates. Cement, glass, zeolites, ceramics and silicones. Chemistry of germanium. Biological aspects of the elements C, Si and Ge.

10. Boron

Boron. Elemental boron. Structure, obtention and applications. Boron oxide, boric acid and borates. Borides and boron halides. boron hydrides and related compounds.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	51,00	100
Tutorials	9,00	100
Study and independent work	43,00	0
Preparation of evaluation activities	21,00	0
Preparing lectures	9,00	0
Preparation of practical classes and problem	17,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

The subject is raised so that the student is the protagonist of their own learning and is structured in the following way:

Lectures. In these classes the teacher will give an overview of the topic object of study with special emphasis on the new aspects or particular complexity. It also will carry out the specific application of the knowledge that students have acquired via the resolution of issues and practical problems that students have previously worked. Logically, these classes will be complemented with the of personal study time referred to section III.

Group tutoring. Students attend them in smaller groups. In them, the teacher can propose activities, as resolution of issues or problems, resolution of doubts, approach to discussions, etc., which will contribute to the final score, as it considers the teacher.

Seminars. Seminars will be also included, with the aim to complement the lectures.

EVALUATION

FIRST SUMMONS

- Mode A

The acquired knowledge will be assessed through a final examination, in the periods established by the faculty, which will weight an 70 % of the final note. The examination will consist of objective questions dedicated to the knowledge considered as basic (see list of the learning outcomes), and numerical problems and relationship that force the student to consider aspects of the subject appearing on various topics.

Professor will evaluate with a 30 % of the final note the participation of the student in any activity that may arise, related to the matter, including:

- Delivery of solved problems and exercises.
- Attendance and participation in discussions also will be considered positively.
- Preparation and oral presentations
- Performance of written tests.
- Class attendance.
- Any other complementary training activities determined by the professor.
- The troubleshooting by the student will also be taken in account.

The overall rating of examination will be obtained from all the planned activities, with the weight indicated. To pass the course, students must achieve a minimum score of 4 in the exam and the final average must be equal or larger than 5

- Mode B

The student who justified reasons unable to regularly attend class can accommodate, at most within one month from the beginning of the course, to be evaluated only by means of a written examination on the date set by the faculty, and the final grade of the student will be the exam note. To pass the course the student must obtain a note equal or higher than 5 on this exam.

- SECOND SUMMONS

In second summons, the student will perform a written exam, on the date set by the faculty, and the final grade of the student will be the obtained note in this exam. To pass the course the student must obtain a note equal or higher than 5 on this exam.

REFERENCES

Basic

- Housecroft, C. E.; Sharpe,A. G.; Inorganic Chemistry, ed. Pearson Prentice-Hall, 3ª edició, 2008. ISBN: 978-0-13-175553-6.
  (En format separat, s'ha publicat el manual de respostes als exercicis plantejats. Existeix una traducció a l'espanyol de la 2ª edició i del manual de respostes d'Ed. Pearson Prentice-Hall, 2006.)
- Atkins,P. W.; Overton,T. L.; Rourke, J.P.; Weller, M.T. y Armstrong, F. A.; Shriver & Atkins: Inorganic Chemistry, ed. Oxford, 5ª edición, 2010. ISBN: 978-0-19-923617-6.
  (Existe una traducción al español de la cuarta edición de Ed. McGraw-Hill, 2008).
- Rayner-Canham,G.; Overton,T.; Descriptive Inorganic Chemistry y Student solutions manual for descriptive inorganic chemistry, ed. W.H. Freeman, 4ª edición, 2006.

Additional

- Cotton,F.A.; Wilkinson,G.; Murillo; C.A.; Bochmann, M.; Advanced Inorganic Chemistry, ed. Wiley-Interscience, 6ª edición, 1999. ISBN: 978-0-471-19957-1
  Existe una traducción al español de la 4ª edición, F.A. Cotton y G. Wilkinson, Química Inorgánica Avanzada, ed. Limusa, 1987.
- Greenwood, N. N.; Earnshaw, A.; Chemistry of the Elements, ed. Elsevier Science, 2ª edición, 1997 (corregida en 1998, con reimpresiones en 2001 y 2002). ISBN: 0-7506-3365-4.
- Wells,F.; "Química Inorgánica Estructural", 4ª ed. Reverté, Barcelona, 1994. ISBN-13: 978-8429175240; ISBN-10: 8429175245

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

Contents

1.- The contents initially indicated in the teaching guide are maintained.

2.- .- The distribution of the teaching and the relationship among the face-to-face activities and not face-to-face could be modified during the academic year if the sanitary emergency conditions because of the Covid-19 so will dictate.

Workload and temporary teaching planning

Regarding the workload:

1.- The different activities described in the Teaching Guide are maintained with the intended dedication.

Regarding the temporary teaching planning:

1.- The material to follow the theory/tutoring/classroom-seminar classes allows to continue the temporary teaching planning both in days and schedule, whether the teaching is face-to-face in the classroom or not.

Teaching Methodology

Theory courses: Theory classes and classroom tutoring will tend to the maximum possible face-to-face teaching, always respecting the health restrictions that limit the capacity of the classrooms to 50% of their usual occupation. Depending on the capacity of the classroom and the number of students enrolled, some of the students may need to follow the classes synchronously in an auxiliary classroom. If this situation arises, students will attend the main classroom or auxiliary classroom for weekly rotary shifts (preferably in alphabetical order). However, the rotation system will be fixed once the actual enrollment data is known, guaranteeing, in any case, that the percentage of face-to-face teaching of all students enrolled in the subject is the same.

If there is a closure of the facilities for health reasons that totally or partially affects the classes of the course, they will be replaced by non-face-to-face sessions following the established schedules and using the tools of the virtual classroom.

The methodology used for non-face-to-face classes shall be:

1. Synchronously using virtual classroom tools (Teams, Blackboard ...)

2. Asynchronously using locut power-point presentations or other virtual classroom tools

3. Resolution of exercises and questionnaires

4. Other (specify)

Evaluation

1. The evaluation system described in the Teaching Guide of the subject in which the various evaluable activities have been specified as well as their contribution to the final grade of the subject is maintained.

If there is a closure of the facilities for health reasons affecting the development of any face-to-face evaluable activity of the subject, it will be replaced by a test of a similar nature that will be carried out in virtual mode using the computer tools licensed by the University of Valencia. The contribution of each evaluable activity to the final grade of the subject will remain unchanged, as set out in this guide.

References

(Indicate the option applicable to the subject)

1.- The literature recommended in the Teaching Guide is maintained since it is accessible, and it is complemented by notes, slides and problems uploaded to the Virtual Classroom as material of the course.