COURSE DATA

Data Subject	
Code	34198
Name	Inorganic chemistry I
Cycle	Grade
ECTS Credits	4.5
Academic year	2016 - 2017

Study (s)

Degree	Center	Acad. year	Period
1108 - Degree in Chemistry	Faculty of Chemistry	2	First term

Subject-matter

Degree	Subject-matter	Character
1108 - Degree in Chemistry	8 - Inorganic chemistry	Obligatory

Coordination

Name	Department
MORATAL MASCARELL, JOSE	320 - Inorganic Chemistry

SUMMARY

One of the most complete definitions of inorganic chemistry is provided by T. Moeller, who defines it as the experimental research and theoretical interpretation of the properties and reactions of all the elements and compounds except for hydrocarbons and most of their derivatives. There are other definitions – such as that of J. E. Huheey – that may seem amusing and/or nonsensical (he defines inorganic chemistry as any area of chemistry of interest to an inorganic chemist). Although this definition apparently adds little to our understanding of this discipline, it is interesting because it highlights the two most characteristic features of inorganic chemistry: (i) its great diversity; and (ii) its interdisciplinary nature. Inorganic chemistry covers the behaviour of more than 100 elements, with thousands of compounds that have very different properties. One of its most attractive characteristics is that it offers such a large number of diverse facts within the same conceptual order. 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 enzymes, (catalysts of biological processes) are made up of coordination compounds whose activity is essentially regulated by metal ions. In our everyday lives, there are plenty of inorganic products that make life easier.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

All students enrolled in this course should have successfully completed General Chemistry I and General Chemistry II. The knowledge acquired in these courses is important when initiating the study of Inorganic Chemistry. Prior knowledge of nomenclature and formulation, thermodynamics and chemical kinetics, equilibria in gas phase, solution equilibria: acid-base, precipitation, and redox is important.
It is recommended that all students enrolled in this course have completed and passed the subjects previous

COMPETENCES (RD 1393/2007) // LEARNING OUTCOMES (RD 822/2021)

1108 - Degree in Chemistry

- Develop capacity for analysis, synthesis and critical thinking.
- Show inductive and deductive reasoning ability.
- Demonstrate leadership and management skills, entrepreneurship, initiative, creativity, organization, planning, control, leadership, decision making and negotiation.
- 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.
- Learn autonomously.
- Demonstrate the ability to adapt to new situations.
- Acquire a permanent sensitivity to quality, the environment, sustainable development and the prevention of occupational hazards.
- 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.
- Relate the macroscopic properties and the properties of individual atoms and molecules, including macromolecules (natural and synthetic), polymers, colloids and other materials.
- Demonstrate knowledge and understanding of essential facts, concepts, principles and theories related to the areas of chemistry.
- 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.
- Relate theory and experimentation.
- Recognise and evaluate chemical processes in daily life.
- Understand the qualitative and quantitative aspects of chemical problems.
- Develop sustainable and environmentally friendly methods.
- Students must be able to apply their knowledge to their work or vocation in a professional manner and have acquired the competences required for the preparation and defence of arguments and for problem solving in their field of study.
- Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.
- Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.
- Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.
- Express oneself correctly, both orally and in writing, in any of the official languages of the Valencian Community.
- Have basic skills in the use of information and communication technology and properly manage the information obtained.

LEARNING OUTCOMES (RD 1393/2007) // NO CONTENT (RD 822/2021)

This course will cover the following skills and outcomes related to inorganic chemistry in the degree course:

• Relating, distinguishing, and recognising the behaviour of chemical elements and their compounds, as well as predicting the properties, link type, structure, and possible reactivity of unspecified inorganic compounds on the basis of the relationship between groups and established variations.

• Assigning and determining the structure of various types of inorganic compounds.

• Understanding and using bibliographic and technical information relating to inorganic compounds.

• Explaining in an understandable way, phenomena and processes related to inorganic chemistry.

• Demonstrating sensitivity to environmental issues.

• Recognising and valuing chemical processes in everyday life.

• Making rigorous decisions.

• Solving problems rigorously.

• Effectively performing the tasks assigned as a member of a team (with a perspective on gender).

• Demonstrating skills in interpersonal relations (with a perspective on gender).

• Demonstrating an ability to use information and communication technologies.

• Explaining in an understandable way experimental phenomena with the theories that support them.

• Demonstrating ethical commitment (with a gender perspective).

• Demonstrating creativity.

• Demonstrating independent learning.

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. Isotops. Obtention of hydrogen, reactivity and aspplications. 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 compouns 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	38,00	100
Tutorials	7,00	100
Study and independent work	32,50	0
Preparation of evaluation activities	16,00	0
Preparing lectures	6,00	0
Preparation of practical classes and problem	13,00	0
TOTAL	**112,50**	

TEACHING METHODOLOGY

The subject is organised so that the student is responsible for independent learning; and is structured as follows:

Lectures. Lecturers will give an overview with special emphasis on new or complex aspects. Specific applications of the knowledge that students have acquired via the resolution of issues and practical problems will be discussed. Logically, these classes must be complemented with independent study time referred to Section III.

Group tutoring. Students attend these sessions in small groups. Lecturers propose activities (such as the resolution of issues or problems, resolution of doubts, discussions, etc.) and the contribution of the student will be reflected by a mark that forms part of the final evaluation.

Seminars. Seminars will complement the lectures.

EVALUATION

Students will be examined on the knowledge acquired in the periods established by the faculty, and an examination will contribute 80 % of the final mark. The examination will consist of objective questions on basic knowledge (see list of the learning outcomes) and numerical problems and relationship that force the student to consider aspects of the subject appearing in various topics. Students who are unsuccessful may resit the exam.

Lecturers will evaluate 20 % of the final mark by evaluating attendance, as well as participation in any activity that may arise – including:

- Handing in solved problems and exercises.
- Attendance and participation in discussions.
- Resolution of problems and questions asked will also be taken into account.

The overall mark will be based on the exam and the other activities (with the weighting indicated). To pass the course, students must achieve a minimum score of 4 in the exam and the final average must be 5 or more.

REFERENCES

Basic

- Housecroft, C. E.; Sharpe,A. G.; Inorganic Chemistry, ed. Pearson Prentice-Hall, 3ª edició, 2008. ISBN: 978-0-13-175553-6.
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- 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.
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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