VNIVERSITAT DE VALÈNCIA

Course Guide
34202 Inorganic chemistry laboratory II

COURSE DATA

Data Subject	
Code	34202
Name	Inorganic chemistry laboratory II
Cycle	Grade
ECTS Credits	6.0
Academic year	2017 - 2018

Study (s)

Degree	Center	Acad. year	Period
1108 - Degree in Chemistry	Faculty of Chemistry	3	Second term

Subject-matter

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

Coordination

Name	Department
ORTIZ BARBERA, ROSA M	320 - Inorganic Chemistry

SUMMARY

Students will learn specific inorganic chemistry techniques in an experimental laboratory and be given the knowledge and tools to design and reproduce experiments at an elementary level.

These objectives are achieved through the synthesis of a series of coordinated inorganic compounds. Various experimental procedures are required for producing these compounds, and then studying their reactivity and chemical properties. Assays of these compounds are also required to familiarise students with techniques commonly used in an inorganic chemistry laboratory.

In parallel to the experimental work and the practical observation of inorganic chemistry concepts, students must keep a laboratory journal that describes the principles of chemistry explored and the observations made in each experiment. As in all practical subjects, students must produce a final report on a set of experiments.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

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

All students enrolled in this course should have completed and passed Chemistry Laboratory I, Chemistry Laboratory II, and Inorganic Chemistry Laboratory I, and therefore understand the common operations and techniques that are used in an inorganic chemistry laboratory.
In addition, although the objectives of the course are essentially practical and experimental, students should have consolidated the contents of Genera

OUTCOMES

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.
- Handle chemicals safely.
- Carry out standard experimental procedures involved in synthetic and analytical work, in relation to organic and inorganic systems.
- Handle the instrumentation used in the different areas of chemistry.
- Interpret data from observations and measurements in the laboratory in terms of their significance and the theories that underpin them.
- Evaluate the risks in the use of chemicals and laboratory procedures.
- 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

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.

• Assign and determine the structure of various types of inorganic compounds.

• Understand and use bibliographic and technical information relating to inorganic compounds.

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

• Demonstrate sensitivity to environmental issues.

• Recognise and value chemical processes in everyday life.

• Make rigorous decisions.

• Solve problems rigorously.

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

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

• Demonstrate ability to use information and communication technologies.

• Demonstrate ability to safely manipulate chemical reagents and inorganic compounds.

• Plan and safely carry out simple experiments for synthesis of inorganic compounds.

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

• Rigorously develop laboratory practice reports.

• Demonstrate ethical commitment (with a gender perspective).

• Demonstrate creativity.

• Demonstrate independent learning.

By means of these learning outcomes, at the end of the course, students will be able to:

• Establish the chemical behaviour of the elements of the representative groups and their compounds.

• Distinguish the types of reactions (acid-base, redox, precipitation) of the elements of the ‘s’ and ‘p’ blocks and their compounds and the factors that influence them.

• Explain the procedures of synthesis of a selection of compounds.

• Explain the design stages to be followed to obtain a particular compound: choice of starting reagents, reaction medium, and reaction conditions (temperature, pH, time, etc.).

• Explain methods of isolation and purification of obtained compounds.

• Choose the most appropriate technique in each case.

• Identify the factors that may optimise the performance of a reaction and apply them.

DESCRIPTION OF CONTENTS

1. Lab 1 (one session) Comparative study of the chemical behaviour of metallic ions of the first transition series.

Stability of different oxidation states. Solution behaviour and reactivity.

2. Lab 2 (one session) Vanadium.

Study of the chemical behaviour of vanadium.

3. Lab 3 (one session) reactions in the absence of air.

Cr(II) acetate. Synthesis and reactivity.

4. Lab 4 (one session) Copper.

Synthesis of copper(I) and copper(II) compounds. Spectrochemistry series.

5. Lab 5 (one session) Preparation of oxalatocomplejos of Fe (II) and Fe (III).

Synthesis and characterization of oxalatocomplexes with formulas [Fe(C2O4)(H2O)2] and K3[Fe(C2O4)3].3H2O. Study of their reactivity.

6. Lab 6 (one session) Dioxygen fixation.

Reversible absorption of dioxygen by a Co(II) complex.

7. Lab 7 (two sessions) Preparation of organometallic compounds.

Acetilferrocene, [Fe(C5H5)(C5H4COCH3)]. Preparation and purification. Ferrocinium preparation.

8. Lab 8 (two sessions) Preparation and resolution of enantiomers.

Preparation and resolution of the enantiomers of the cation [Co(en)3]3+.

9. Lab 9 (two sessions) Co(III) complexes.

Synthesis and characterization of the complexes [CoCl(NH3)5]Cl2 and [Co(NH3)6]Cl3. Synthesis and characterization of bond isomers [Co(ONO)(NH3)5]Cl2 and [Co(NO2)(NH3)5]Cl2 and study of the interconversion of isomers.

WORKLOAD

ACTIVITY	Hours	% To be attended
Laboratory practices	48,00	100
Tutorials	12,00	100
Development of individual work	20,00	0
Preparation of evaluation activities	48,00	0
Preparation of practical classes and problem	22,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

Laboratory work is the core of this course with individual students (preferably) or teams (groups of two) performing the experiments. Attendance at laboratory sessions is compulsory.

All experimental works will be carried out under the supervision of a lecturer.

• Previous work. Before attending the laboratory, students must carefully read the notes for each session, review the theoretical concepts, resolve a number of questions, and prepare an outline of the experimental procedure.

• Laboratory sessions. During the sessions, the lecturer will make a brief explanation of the most important aspects of the experimental work and the safety measures to be followed. Lecturers will then help students by answering questions or correcting errors. Student will bring their laboratory journals (with previous work done) to the lab sessions and record all observations and significant events – including data measurements (weight of reactants, pH, temperature, time, etc.). Tidiness and orderliness will be emphasised to prevent students acquiring bad habits.

• Post work. Students will analyse the observations and data in their journals and record relevant findings. They must answer any additional questions – as well as calculate and discuss the performance of the synthesis, where applicable, and reflect on whether or not the objectives were reached.

• Preparation of report, presentation, or alternative exercise. Lecturers may ask students to report on a part of the experimental work, or make a presentation, or prepare an alternative exercise.

EVALUATION

Overall evaluation will be made according to the following criteria:

• Laboratory work preparation. The degree of preparation will be assessed, by asking questions during the seminar prior to the practice and/or a daily review of the laboratory journal – and this will contribute 20 % of the total grade.

• Laboratory work. Because that is a highly experimental subject, student work in the laboratory (i.e., interest, attitude, tidiness, cleanliness, and journal notes will be highly valued aspects. Laboratory work will be evaluated continuously and contribute 20 % of the total grade.

• Laboratory journal. A journal only for this subject must be made available to the lecturer at any time for review. It must include pre-work, notes during the lab session, and subsequent work, with the corresponding performance calculations, if any. This section contributes 20 % of the total grade.

• Laboratory report, presentation, or an alternative exercise. The lecturer may ask students for an individual presentation or report on the experimental work done, or an alternative exercise. The lecturer will indicate in advance, on which part of the experiment the work should be based, and the deadline for delivery. This work will contribute 20 % of the total grade.

• Exam. All students will be examined at the end of the course and must demonstrate knowledge and/or skills acquired in areas directly related to the operations carried out, materials used, and the content developed during the lab sessions. The exam result will contribute 20 % of the total grade.

To obtain a pass grade it is necessary to attend all laboratory sessions and pass all evaluations with a 5.0 or more out of 10.

In the case of justified absence for serious reasons, an effort must be made to recover the missed session. Resits will consist of a written exam and/or a practical examination in the laboratory.

NOTE: This course is excluded from the regulations on advance calls for completing graduate studies (Degree Committee agreement of 26/03/2015).

REFERENCES

Basic

- Guión de prácticas, Laboratorio de Química Inorgánica II, aprobado por el Departamento de Química Inorgánica, Universidad de Valencia.

Additional

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  (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.)
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- 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
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- 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.
- Kettle,S. F. A.; Physical Inorganic Chemistry: A Coordination Chemistry Approach, Ed. Oxford University Press, 2000. ISBN-13: 978-0198504047
- Ribas Gispert,J. Química de Coordinación, Edicions de la Universitat de Barcelona/Ediciones Omega, 2000. ISBN: 84-282-1210-4
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- Angelici,R.J.; Técnica y Síntesis en Química Inorgánica, Ed. Reverté, 2ª ed., 1979. ISBN: 84-291-7018-9
- Inorganic Syntheses, 1939-1977, Ed. McGraw-Hill Inc., volumes 1 to 17; 1978-1995, Ed. John Wiley & Sons Inc., volumes 18-30. Volúmenes de síntesis de compuestos inorgánicos comprobadas.
- En el guión de cada práctica, hay al final una bibliografía complementaria específica para cada tema tratado.