COURSE DATA

Data Subject	
Code	34201
Name	Inorganic chemistry laboratory I
Cycle	Grade
ECTS Credits	6.0
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
SANAU TORRECILLA, MERCEDES	320 - Inorganic Chemistry

SUMMARY

Students will learn the basic skills and laboratory techniques of inorganic chemistry in an experimental laboratory. They will become familiar with the materials, instrumentation, and basic operations of inorganic chemistry by performing experiments related to the reactivity and chemical properties of the elements of the representative groups and their inorganic compounds, and the synthesis of some inorganic compounds.

The subject is organised so that students make a basic theoretical study of the chemical behaviour of the elements or compounds before each experiment. This study is followed by an experimental part that employs specific laboratory techniques. Subsequently, a series of complementary experiments enables a study of the reactivity and properties of the synthesised substances (always following rules and safety recommendations). Laboratory work simultaneously reinforces and enhances an understanding of the theoretical concepts used in inorganic chemistry.

This subject stresses the need for a laboratory journal to be kept and students are taught how to report on experimental work in chemical language so that the experiments can be reproduced.

Results are analysed and, where appropriate, discrepancies between expected and observed results are discussed by analysing possible causes. A critical review is made of the steps taken to discover errors that might explain discrepancies.

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 in the curriculum.

All students enrolled in this course must have previously passed Chemistry Laboratory I and Chemistry Laboratory II, and therefore understand common chemistry laboratory operations. In addition, although the objectives of the course are essentially practical and experimental, students must have studied the contents of General Chemistry I and General Chemistry II, and must be studying Inorganic Chemistry I.

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:

• Learn how to relate, distinguish, and recognise the behaviour of chemical elements and their compounds, as well as predict 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 an ability to use information and communication technologies.

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

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

• Explain in 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, the student 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, the 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. Synthesis of sodium bicarbonate and carbonate to the Solvay process.

Synthesis of sodium bicarbonate and sodium carbonate by means of the Solvay. process.

2. Boric acid and borates.

Obtention of boric acid. Acid-base properties of boric acid. Preparation of borates and ethoxide of boron.

3. Properties and reacctions of aluminium.

Properties and reactions of aluminum. Reactivity of aluminum with acids, alkalis and oxygen. Reducing properties of aluminum. Obtention and amphoteric behavior of aluminum hydroxide.

4. Silicon compounds.

Silicon compounds. Preparation and properties of a zeolite. Silanes.

5. Nitrogen compounds.

Nitrogen compounds. Obtention and study of the chemical properties of the nitrogen monoxide and dioxide. Identification and reactivity of nitrite and nitrate.

6. Phosphoric acid and phosphates.

Phosphoric acid and phosphates. Preparation of dihydrogen phosphate, monohydrogen phosphate, phosphate, and sodium pyrophosphate. Reactivity tests.

7. Sulfur and its compounds.

Sulfur and its compounds. Allotropy. Preparation of sodium tetrathionate.

8. Obtention of sulphuric acid by the method of contact

Obtention of sulphuric acid by the method of contact. Mounting of the experimental device. Preparation of sulfuric acid. Determination of the purity of the product obtained. Reactivity of sulfuric acid.

9. Halogens (I).

Halogens (I). Reactivity and properties of halogens. Use of Frost diagrams.

10. Halogens (II).

Halogens (II). Synthesis of sodium metaperyodato. Determination of purity by redox titration.

11. Comparative study of the chemical behavior of metallic ions of the block "s".

Comparative study of the chemical behavior of metallic ions of the block "s".

12. Design of a synthesis or essay and its preparation in the laboratory.

Design of a synthesis or essay and its preparation in the laboratory.

WORKLOAD

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

TEACHING METHODOLOGY

Laboratory work by individual students (preferably) or teams (groups of two) is the core of this course. 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. Students 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 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, the 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 the evaluations with a 5.0 or more out of 10.

In the case of justified absence for significant 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.

REFERENCES

Basic

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Additional

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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.
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