VNIVERSITAT DE VALÈNCIA

Course Guide
34201 Inorganic Chemistry Laboratory I

COURSE DATA

DATA SUBJECT

Code: 34201
Name: Inorganic Chemistry Laboratory I
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1110 - Degree in Chemistry	Facultat de Química	2	First quarter
1929 - Double Degree Program in Physics and Chemistry	Facultat de Física	3	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1110 - Degree in Chemistry	Inorganic Chemistry	COMPULSORY
1929 - Double Degree Program in Physics and Chemistry	Tercer Curso (Obligatorio)	COMPULSORY

COORDINATION

FORMENT ALIAGA ALICIA

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

1110 - Degree in Chemistry
Obligation to take the subject(s) simultaneously — 36452 - Inorganic Chemistry I

1929 - Double Degree Program in Physics and Chemistry
Obligation to take the subject(s) simultaneously — 36452 - Inorganic Chemistry I

OTHER REQUIREMENTS

All students enrolled in this course must have previously completed 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.

COMPETENCES / LEARNING OUTCOMES

1108 -

Ability to recognise chemical elements and their compounds: preparation, structure, reactivity, properties and applications.

Acquire a permanent sensitivity to quality, the environment, sustainable development and the prevention of occupational hazards.

Carry out standard experimental procedures involved in synthetic and analytical work, in relation to organic and inorganic systems.

Demonstrate ability to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences and using information technology, as appropriate.

Demonstrate ability to work in teams both in interdisciplinary teams and in an international context.

Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional.

Demonstrate knowledge and understanding of essential facts, concepts, principles and theories related to the areas of chemistry.

Demonstrate knowledge of the main aspects of chemical terminology, nomenclature, conventions and units.

Demonstrate knowledge of the main types of chemical reaction and their main characteristics.

Demonstrate knowledge of the principles, procedures and techniques for the determination, separation, identification and characterisation of chemical compounds.

Demonstrate knowledge of the principles of thermodynamics and kinetics and their applications in chemistry.

Demonstrate the ability to adapt to new situations.

Develop capacity for analysis, synthesis and critical thinking.

Develop sustainable and environmentally friendly methods.

Evaluate, interpret and synthesise chemical data and information.

Evaluate the risks in the use of chemicals and laboratory procedures.

Express oneself correctly, both orally and in writing, in any of the official languages of the Valencian Community.

Handle chemicals safely.

Handle the instrumentation used in the different areas of chemistry.

Have basic skills in the use of information and communication technology and properly manage the information obtained.

Interpret data from observations and measurements in the laboratory in terms of their significance and the theories that underpin them.

Interpret the variation of the characteristic properties of chemical elements according to the periodic table.

Learn autonomously.

Recognise and analyse new problems and plan strategies to solve them.

Recognise and evaluate chemical processes in daily life.

Relate the macroscopic properties and the properties of individual atoms and molecules, including macromolecules (natural and synthetic), polymers, colloids and other materials.

Relate theory and experimentation.

Show inductive and deductive reasoning ability.

Solve problems effectively.

Solve qualitative and quantitative problems following previously developed models.

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 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.

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.

Understand the qualitative and quantitative aspects of chemical problems.

1110 - Degree in Chemistry

Act autonomously in learning, making well-founded decisions in various contexts, forming judgements based on experimentation and analysis, and applying knowledge to new situations.

Address new problems and propose strategies to solve them.

Collaborate effectively in work teams, assume responsibilities and leadership roles, and contribute to collective improvement and development.

Communicate effectively both orally and in writing, adapting to the context and audience.

Contribute to the design, development and implementation of solutions that respond to social demands, using the Sustainable Development Goals as a reference.

Demonstrate both inductive and deductive reasoning skills.

Demonstrate critical and self-critical thinking, considering professional ethics, moral values and social implications of the different activities carried out throughout the degree.

Demonstrate the ability to analyse, synthesise and reason critically.

Distinguish between the qualitative and quantitative aspects of chemical problems.

Distinguish the principles, procedures and techniques used in the determination, separation, identification and characterisation of chemical compounds.

Evaluate the risks involved in the use of chemical substances and laboratory procedures.

Express ideas correctly, both orally and in writing, in any of the official languages of the Valencian Community.

Identify chemical elements and their compounds, including their extraction, structure, reactivity, properties and applications.

Identify chemical processes in everyday life.

Identify the main types of chemical reactions and their associated key characteristics.

Implement sustainable and environmentally friendly methodologies.

Interpret the relationship between the variation in the characteristic properties of chemical elements and the Periodic Table.

Propose creative and innovative solutions to complex situations or problems in the field, addressing diverse professional and social needs.

Relate theory to experimentation.

Solve problems effectively.

State the principles of thermodynamics and kinetics and their application in chemistry.

Understand and analyse, from the perspective of the degree programme, social inequalities based on sex and gender; integrate gender-sensitive approaches into problem-solving and solution design.

Use chemical terminology, nomenclature, conventions and units correctly.

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. Chemical garden, microesferes, silica gel, zeolites.

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. Potentiometric titration of a phosphoric acid solution. Preparation and use of a buffer solution.

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. Tin compounds

Preparation of several tin compounds and study of their properties according to the type of chemical bonding.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	12,00
Laboratory	48,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	20,00
Independent study and work	48,00
Preparation of lessons	22,00
Preparation for assessment activities	0,00
Resolution of case studies	0,00
Total hours	**90,00**

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

The global evaluation will be done according to the following criteria:

¿ Prior to the laboratory work.- The degree of preparation of lab sessions will be assessed through the preliminaries that take place during the seminar prior to the practicals and/or through the daily review of the notebook. It will contribute 10 % of the total grade.

¿ Work in the laboratory.- Because this is a highly experimental subject, the student work in the laboratory, i.e., interest, attitude, neatness, cleaning work and suitable work in the notebook will be highly valued aspects. Laboratory work will be evaluated continuously and it will contribute 20 % of the total grade.

¿ Laboratory diary.- A laboratory notebook must be used exclusively for this subject. The notebook must be available to the teacher at any time for review. It must include the pre-work, annotations during the lab session and later work, with the corresponding yield calculations, if any. This section will be valued at 20 % of the total grade.

¿ Memory or lab report, presentation or an alternative exercise.- The lecturer may ask students, individually, for the writing of a memory or report on the experimental work done, the presentation of it, or an alternative exercise. The lecturer will indicate, in advance, to each student the extent of the work and to which experimental part should be related, as well as the deadline for delivery. This work will be valued at 10 % of the total grade.

¿ Exam.- All students must take an exam at the end of the course, in which they demonstrate their knowledge and/or skills acquired, through issues directly related to the operations carried out, the material used, and the content developed during the lab sessions. The note of exam will be 40 % of the total grade.

In any case, in order to overcome the subject, it is required to pass all the items subjected to evaluation with a grade equal or greater than 5.0 out of 10.

Attendance to all laboratory sessions is mandatory. In case of absence, justified for serious reasons, the student must try to recover this missed lab session.

Resits will consist of a written exam and/or a practical examination in the laboratory.

Final warning

Copying or plagiarism of any assignment that is part of the evaluation will make it impossible to pass the course, and the student will be subject to the appropriate disciplinary procedures.

Please note that, according to Article 13 d) of the University Student Statute (RD 1791/2010, December 30), "*it is the duty of a student to refrain from using or cooperating in fraudulent procedures in evaluation tests, in the work performed or in official University documents*".

REFERENCES

BASIC

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

ADDITIONAL

- Housecroft, C. E.; Sharpe,A. G.; Inorganic Chemistry, ed. Pearson Prentice-Hall, 3ª edició, 2008. ISBN: 978-0-13-175553-6. (In a separate format, the answer manual for the exercises has been published. There is a Spanish translation of the 2nd edition and the answer manual. 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. (There is a Spanish translation of the fourth edition by 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. ISBN 10: 1-4292-1814-2. (There is a Spanish translation of the 2nd edition by G. Rayner-Canham, Química Inorgánica Descriptiva, ed. Prentice Hall, 2000)
- 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. There is a Spanish translation of the 4th edition, 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.
- Malati,M. A.; "Experimental Inorganic/Physical Chemistry, an investigative, integrated approach to practical project work", Horwood Publishing Limited, Horwood series in chemical science, 1999. ISBN-13: 978-1898563471