COURSE DATA

DATA SUBJECT

Code: 34202
Name: Inorganic Chemistry Laboratory II
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2026-27

STUDY (S)

Degree	Center	Acad. year	Period
1110 - Degree in Chemistry	Facultat de Química	3	Second quarter
1929 - Double Degree Program in Physics and Chemistry	Facultat de Física	4	Second quarter
1934 - Double Degree Program in Chemistry-Chemical Engineering	Facultat de Química	5	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1110 - Degree in Chemistry	Inorganic Chemistry	COMPULSORY
1929 - Double Degree Program in Physics and Chemistry	Cuarto Curso (Obligatorio)	COMPULSORY
1934 - Double Degree Program in Chemistry-Chemical Engineering	Quinto curso	COMPULSORY

COORDINATION

BOLINK HENDRIK JAN

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.

Regarding the Sustainable Development Goals (SDG), it is expected that students will be able to know in this subject how to apply the knowledge learned to guarantee an inclusive, equitable, and quality education and promote learning opportunities for everyone (SDG 4), to acquire a special sensitivity for sustainable management of water (SDG 6), raw materials and energy sources (SDG 7), as well as for an environmentally friendly and sustainable development (SDG 11 , 12, 13, 14 and 15), in addition to being able to design, select and/or develop efficient chemical products, processes and/or analytical methodologies (SDG 7) that minimize their impact on the environment (SDGs 14 and 15), using alternative raw materials and reducing wastes (SDG 11).

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

1110 - Degree in Chemistry
Obligation to take the subject(s) simultaneously — 34200 - Inorganic Chemistry III

1929 - Double Degree Program in Physics and Chemistry
Obligation to take the subject(s) simultaneously — 34200 - Inorganic Chemistry III

1934 - Double Degree Program in Chemistry-Chemical Engineering
Obligation to take the subject(s) simultaneously — 34200 - Inorganic Chemistry III

OTHER REQUIREMENTS

All students enrolled in this course should have completed the subjects previously Chemistry Laboratory I, Chemistry II Laboratory, and Laboratory of Inorganic Chemistry I and therefore, know the typical operations that are performed and some of the characterization techniques that are used in a laboratory of Inorganic Chemistry.
In addition, although the objectives of the course is essentially practical and experimental, the students should have consolidated the contents of the subjects General

COMPETENCES / LEARNING OUTCOMES

1110 - Degree in Chemistry

Act autonomously in learning, making informed decisions in different contexts, forming judgements based on experimentation and analysis, and transferring knowledge to new situations.

At the end of the course, the student will be able to address new problems and develop strategies to solve them.

At the end of the course, the student will be able to assess risks in the use of chemical substances and laboratory procedures.

At the end of the course, the student will be able to distinguish between qualitative and quantitative aspects of chemical problems.

At the end of the course, the student will be able to distinguish the principles, procedures and techniques used for the determination, separation, identification and characterisation of chemical compounds.

At the end of the course, the student will be able to identify chemical elements and compounds, including their production, structure, reactivity, properties and applications.

At the end of the course, the student will be able to identify chemical processes in everyday life.

At the end of the course, the student will be able to identify the main types of chemical reactions and their key characteristics.

At the end of the course, the student will be able to implement sustainable and environmentally friendly methodologies.

At the end of the course, the student will be able to relate theory and experimentation.

At the end of the course, the student will be able to solve problems effectively.

At the end of the course, the student will be able to state the principles of thermodynamics and kinetics and apply them in chemistry.

At the end of the course, the student will correctly use chemical terminology, nomenclature, conventions and units.

At the end of the course, the student will demonstrate inductive and deductive reasoning skills.

At the end of the course, the student will demonstrate the ability to analyse, synthesise and apply critical reasoning.

At the end of the course, the student will interpret the relationship between the variation of the characteristic properties of chemical elements and the periodic table.

Collaborate effectively in teams, assuming responsibilities and leadership roles and contributing to collective improvement and development.

Communicate effectively, both orally and in writing, adapting to the characteristics of the situation and the audience.

Contribute to the design, development and implementation of solutions that address social needs, taking the Sustainable Development Goals as a reference.

Demonstrate critical and self-critical reasoning within the field of study, considering aspects such as professional ethics, moral values and the social implications of the different activities undertaken.

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

Propose creative and innovative solutions to complex situations or problems within the field of study, in order to respond to diverse professional and social needs.

Understand and recognise, from within the discipline, inequalities based on sex and gender in society; integrate different needs and preferences related to sex and gender into problem-solving and solution design.

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 oxalatocomplexes of Fe(II) and Fe(III).

Synthesis and characterization of oxalatocomplexes of formulae [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.

Acetylferrocene, [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 [Co(CO3)(NH3)4]NO3, [CoCl(NH3)5]Cl2 and [Co(NH3)6] Cl3. Synthesis and characterization of linkage isomers [Co(ONO)(NH3)5]Cl2 and [Co(NO2)(NH3)5]Cl2 and study of the interconversion of isomers.

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	0,00
Preparation of lessons	22,00
Preparation for assessment activities	48,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

The core of this course is the assistance of the student to the laboratory and the individual realization (preferably) or team (couples) the proposed experiments, since the main objective that is intended is the training on laboratory work. Therefore, attendance at laboratory sessions is essential and compulsory.

All experimental works will be carried out under the eyes of the teacher.

• Previous work.- The student must prior to attending the lab, consisting of carefully reading the script of each practice, work reviewing the theoretical concepts involving the resolution of a number of previous questions and preparing an outline of the experimental procedure.

• Realization of practice. - During the lab session, the teacher made a brief explanation of the most important aspects of the experimental work to be performed, and the risks and safety measures to follow. Thereafter, assist the student during handling in any doubt that this error may have or may commit. During the lab session, the student shall be provided laboratory diary which consist previous work done, and which record all observations and significant events taking place throughout practice, will also include all data measurements (weight of reactants, pH, temperature, time, etc.). On the other hand, will emphasize that it is essential in laboratory work cleaning and order, the student will try minding that this is a habit that must

acquire and that not doing so leads to bad habits difficult to remove later.

• Post work.- The student will analyze the observations and data in your notebook and record relevant findings. Will answer, if any, additional issues that the screenplay indicates. Also calculate and discuss the performance of the synthesis, where applicable, and will reflect on whether or not reached the objectives.

• Elaboration of a report, presentation or an alternative exercise. - The teacher could request to the student the elaboration of an report about a part of the experimental work previously performed, the presentation of it or 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. You 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 teacher may ask the student, individually, for the writing of a memory or report on the experimental work done, the presentation of it, or an alternative exercise. The teacher 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, to overcome the subject it will be required to attend all sessions of laboratory and overcome 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.

Second call: Previous work, laboratory work, laboratory notebook and laboratory report constitute a continuous evaluation process. Hence, the grade obtained in these four items, that was applied in the first call, will be maintained in the second call. It will be not possible to have a second opportunity for these items in the second call.

This second evaluation will be completed through a second examination in a written format and/or a practical examination at 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*".

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- 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.)

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- 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

- Miessler, G.L.; Tarr,D:A.; Inorganic Chemistry, 5ª Ed. Ed. Pearson Prentice Hall, 3ª ed., 2014. ISBN: 0321811054

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- 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.

- Compromiso ético con el Código Europeo de conducta http://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-ethics_code-of-conduct_en.pdf