PERSONA CIÈNCIA EMPRESA
UNIVERSITAT RAMON LLULL

COURSE: CHEMICAL AND ENGINEERING LABORATORY I

SUBJECT MATTER: Inorganic Chemistry
MODULE: Specific Technology
PROGRAM: Degree in Chemical Engineering

GENERAL FEATURES

Type: ☐ Basic Formation, ☑ Compulsory, ☐ Elective

☐ Final Degree Project, ☐ Internship

Duration: Semestral **Semester / s**: 3
Number of ECTS credits: 5
Language / s: Spanish, Catalan, English

DESCRIPTION

SHORT DESCRIPTION AND JUSTIFICATION

Chemical and Engineering Laboratory I is taught simultaneously to the course of Inorganic Chemistry and complements it. This area is, together with Organic Chemistry, Analytical Chemistry and Physical Chemistry, one of the four main areas of Chemistry.

The laboratory focuses on the synthesis and characterization of inorganic compounds. For this, the usual techniques of preparation, separation and purification of inorganic compounds are used. We work on concepts related not only to basic laboratory operations, but also to the practical application of fundamental aspects of inorganic compounds and their industrial uses.

COMPETENCES

- Be able to understand and apply knowledge of Inorganic Chemistry for application in the field of Chemistry. (CB1, E2)
- Be able to identify, formulate and solve problems in the field of Inorganic Chemistry. (CB2, E7)
- Be able to assess risks in the use of chemical and biological substances. (E11)
- Be able to carry out experiments to achieve the requirements established in the activity to be carried out in the practice of Inorganic Chemistry. (CB2, E5)
- That students are able to convey information, ideas, problems and solutions to both specialized and non-specialized audiences. (CB4)
- Be able to assess the impact of their professional activity on the sustainable development of society. (T3)
- Knowledge of material and energy balances, biotechnology, material transfer, separation operations, chemical reaction engineering, reactor design, and valorization and transformation of raw materials and energy resources. (TE1).

PREVIOUS REQUIREMENTS

According to teaching planning and current academic regulations.

CONTENTS

Synthesis and preparative techniques:

1. Precipitation and crystallization.
2. Distillation and reflux.
3. Generation of gas streams.
4. Redox tank and electrodeposition.

Practices:

1. Synthesis of lead chromate. (Level I)
2. Synthesis of cobalt (II) chloride. (Level I)
3. Synthesis of copper oxalate complexes. (Level I)
4. Synthesis of potassium iodate. (Level I)
5. Obtaining Mohr salt. (Level II)
6. Synthesis of hexol. (Level II)
7. Synthesis of copper sulphate and recovery of metallic copper. (Level II)
8. Deposit of a nickel coating. (Level II)
9. Obtaining nitric acid. (Level III)
10. Synthesis of tin iodide (IV). (Level III)
11. Synthesis of sodium carbonate by Solvay method. (Level III)
12. Qualitative inorganic reactivity.

The practices are classified into 3 levels of difficulty: Level I (easy: a technique and / or a synthetic stage); Level II (average: several techniques and / or synthetic stages); Level III (difficult: complex synthetic assemblies and / or with several synthetic stages).

METHODOLOGY

LEARNING ACTIVITIES

Learning Activities	Hours	ECTS Credits	Competences
Lectures	5	0,2	CB1, E2, CB2, E7, E11, T3, TE1
Case and Problem-Solving Sessions	3	0,1	CB1, E2, CB2, E7, E11, T3, TE1
Seminars	8	0,3	CB1, E2, CB2, E7, E11, T3, TE1
Practical and Lab Work	91	3,4	CB1, E2, CB2, E7, E5, E11, T3, TE1
Presentations	14	0,5	CB1, E2, CB2, E7, E11, T3, CB4, TE1
Personal Study	-	-	-
Assessment Tasks (Exams, Continuous Assessment...)	14	0,5	CB1, E2, CB2, E7, E11,T3, TE1
TOTAL	**135**	**5,0**	

TEACHING METHODOLOGY

The didactic methodology is based on practical laboratory sessions where the student faces the synthesis and characterization of different inorganic chemical compounds. In addition, some seminars are given that will reinforce the theoretical and practical concepts that are necessary to carry out laboratory practices.

Dynamics of the laboratory follows approximately the following scheme:

- Assignment of the practice.
- Small bibliographic search.
- Obtaining information on the handling of chemical products and on the treatment of the waste that will be generated.
- Calculations, experimental assembly scheme and professor review.
- Preparation of the necessary assemblies.
- Performing of the experiment and necessary measurements.
- Data processing and discussion of the results obtained.
- Answering final questions, when appropriate.

All the data obtained and observations made during the study, including charts and diagrams, are recorded in a laboratory journal. All the activity carried out in the laboratory must be recorded in the journal.

For personal work by the student, support documents and bibliographic resources will be provided through the support system for learning.

To facilitate the understanding and discussion of the practices, as well as for the student to exercise oral communication of scientific experimentation, presentations and defense of the practices carried out by the students are organized.

ASSESSMENT

ASSESSMENT METHODS

Assessment methods	Weight	Competences
Final Exam	10%	CB1, CB2, E2, E7, E11, T3, TE1
Midterm Exam/s	-	-
Continuous Assessment Activities (laboratory diary)	30%	CB1, CB2, E2, E7, E11, T3, TE1
Lab or Field Work	40%	CB1, CB2, E2, E5, E7, E11, T3, TE1
Reports	10%	CB1, CB2, CB4, E2, E7, T3, TE1
Presentations	10%	CB1, CB2, CB4, E2, E7, E11, T3, TE1
Projects	-	-
Host Student Evaluation	-	-
Participation	-	-

LEARNING OUTCOMES

- The student must know how to interpret the meaning of the main properties of the elements, acid - base equilibria and redox equilibria. (→ E2, CB1, TE1).
- The student must demonstrate the knowledge of the chemical reactivity of the elements, as well as their ability to solve the problems derived from the concepts that make up the subject. (→ E2, CB1, E7, CB2, TE1).
- The student must demonstrate their ability to design processes for obtaining inorganic chemical products from materials and must demonstrate their knowledge of the main chemical properties of the most important chemical products. (→ E7, CB2, E5, E11, T3, TE1).
- The student must demonstrate his capacity to prevent situations of risk derived from incorrectly designed chemical processes. (→ E11, T3, TE1).
- The student must demonstrate their ability to communicate effectively both orally and in writing. (→ CB4).

QUALIFICATION

Formative evidences: In the assessment of the course the marks of the questionnaires of final questions (FP) will be considered; the synthesized products that the students deliver at the end of the practices and the quality of the experimental work carried out (TE); revisions of the laboratory diary (DL); the presentation (PR) and the final exam (EF). All these notes will be over 10 and will have a maximum value of 10.

Calculation of the final grade: The final grade (NF) will be calculated according to:

$$NF = 0{,}4 \times TE + 0{,}3 \times DL + 0{,}1 \times PF + 0{,}1 \times PR + 0{,}1 \times EF$$

Necessary and sufficient conditions to approve the course: If the final grade is equal or superior to five, the course is approved; if it is lower, the course is failed. In addition, to be able to pass the course it is necessary:

1. Have carried out a minimum of 8 laboratory practices, specifically: 4 of Level I, 2 of Level II, 1 of Level III and Practice 12. Otherwise, the final grade of the course will be 3.5 and the course will be failed. Later, in second calls, those practices not carried out previously will be passed through a practical exam in the same laboratory. In this case, the experimental work and the laboratory journal will be evaluated.
2. Have a minimum grade of 4.0 on the final exam. Otherwise, the final grade will be the lowest of the exam grade, the presentation and the laboratory diary; later, in second calls, the final (written) exam will be carried out in the same laboratory.
3. Have a minimum grade of 4.0 in the presentation. Otherwise, the final grade will be the lowest of the exam grade, the presentation and the laboratory diary; subsequently, in second calls the presentation will be carried out.
4. Have a minimum (average) grade of 4.0 in the laboratory journal. Otherwise, the final grade will be the lowest of the exam grade, the presentation and the laboratory diary; Later, in second calls, the laboratory diary will be passed by carrying out a new practice in the same laboratory.

In case of performing additional practices (9 or more), the 8 best grades will be chosen. Likewise, the qualification of the "experimental work" (TE) may be increased by 10% per practice if the quality of the product obtained at the end is exceptionally good; for this, the best 5 products of each practice will be selected at the end of all laboratory sessions, to which the increase will be applied.

ASSESSMENT OF THE COMPETENCES

- For the evaluation of the competence CB1 / E2, the grade of follow-up activities and the final exam will be used as an indicator.
- For the evaluation of the competence CB2 / E7, the grade of follow-up activities and the final exam will be used as an indicator.
- For the evaluation of the competence CB2 / E5, the grade of the experimental work will be used as an indicator.
- For the evaluation of the E11 competence, the grade of follow-up activities and the final exam will be used as an indicator.
- For the evaluation of the CB4 competence, the grade of the work and the presentation will be used as an indicator.
- For the evaluation of the T3 competence, the grade of follow-up activities and the final exam will be used as an indicator.
- For the evaluation of the TE1 competence, the final grade of the course will be used as an indicator.

BIBLIOGRAPHY

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- G. A. Carriedo, Problemas y cuestiones en síntesis y reactividad inorgánica. Ed. Síntesis, 2015.
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- J. D. Woollins (editor). Inorganic Experiments. Ed. Wiley-VCH, 2nd edition, 2003.
- Multiple authors. CRC Handbook of Chemistry and Physics, 84th edition, 2003-2004.
- Own material and scientific articles (Journal of Chemical Education).

DOCUMENT HISTORY

PREVIOUS REVISIONS
September 12th 2017, Dr. Damián Monllor Satoca.
September 8th 2016, Dr. Damián Monllor Satoca.
September 15th 2015, Dr. Damián Monllor Satoca.
April 30th 2012, Dr. Carles Colominas Guàrdia.
October 20th, 2010, Dr. Carles Colominas Guàrdia.

CURRENT REVISION
September 6th 2018. Dr. Damián Monllor Satoca