



Universitat de Lleida

# DEGREE CURRICULUM **CHEMISTRY**

Coordination: RIUS CARRASCO, ANTONI

Academic year 2022-23

Subject's general information

|   |  |               |                  |                  |
|---|--|---------------|------------------|------------------|
| <b>Subject name</b>   | CHEMISTRY  |               |                  |                  |
| <b>Code</b>   | 102327   |               |                  |                  |
| <b>Semester</b>   | 1st Q(SEMESTER) CONTINUED EVALUATION   |               |                  |                  |
| <b>Typology</b>   | <b>Degree</b>  | <b>Course</b> | <b>Character</b> | <b>Modality</b>  |
|   | Bachelor's degree in Industrial Organization and Logistics Engineering   | 1             | COMMON/CORE      | Attendance-based |
|   | Common branch in industrial engineering programs - Igualada  | 1             | COMMON/CORE      | Attendance-based |
|   | Double degree: Bachelor Degree in Industrial Organisation and Logistics Engineering and Business Administration and Management | 2             | COMMON/CORE      | Attendance-based |
|   | Not informed   | 1             | COMMON/CORE      | Attendance-based |
| <b>Course number of credits (ECTS)</b>  | 6  |               |                  |                  |
| <b>Type of activity, credits, and groups</b>                                    | <b>Activity type</b>   | <b>PRALAB</b> | <b>PRAULA</b>    | <b>TEORIA</b>    |
|   | <b>Number of credits</b>   | 2.1           | 0.9              | 3                |
|   | <b>Number of groups</b>  | 7             | 1                | 1                |
| <b>Coordination</b>   | RIUS CARRASCO, ANTONI  |               |                  |                  |
| <b>Department</b>   | CHEMISTRY  |               |                  |                  |
| <b>Teaching load distribution between lectures and independent student work</b> | 60 hours in person/on-line (40%)<br>90 hours autonomous work (60%)   |               |                  |                  |
| <b>Important information on data processing</b>                                 | Consult <a href="#">this link</a> for more information.  |               |                  |                  |
| <b>Language</b>   | Catalan  |               |                  |                  |
| <b>Distribution of credits</b>  | Theoretical 3<br>Room practices 0,9<br>Room Lab 2,1  |               |                  |                  |

| Teaching staff            | E-mail addresses          | Credits taught by teacher | Office and hour of attention |
|---------------------------|---------------------------|---------------------------|------------------------------|
| CANTERO GOMEZ, MARIA ROSA | rosa.cantero@udl.cat      | 2,1                       |                              |
| MORERA PRAT, JOSEP MARIA  | josepmaria.morera@udl.cat | 2,1                       |                              |
| RIUS CARRASCO, ANTONI     | antoni.rius@udl.cat       | 14,4                      |                              |

## Subject's extra information

It is advised: the continuous work of the student, reading the bibliography and solving the exercises that are proposed; frequently visit the Virtual Campus of the subject, as it will pay for useful material (copy of class theoretical presentations, exercises collections, instructions for doing internships and work ...); And take advantage of the hours of consultation / tutoring with the teachers.

There are no prerequisites for taking the course.

### GENERAL NORMS OF SECURITY IN LABORATORY PRACTICES

It is **COMPULSORY** that the students bring the following elements of individual protection (EPI) to the practices at the laboratory.

- Laboratory gown from UdL
- Protection glasses
- Mechanical protection gloves

They can be purchased through the shop Údels of the UdL:

C/ Jaume II, 67 baixos  
Centre the Cultures i Cooperació Transfronterera

<http://www.publicacions.udl.cat/>

There will be a specific service for the *Campus Universitari d'Igualada*.

The use of other elements of protection (for example caps, masks, gloves of chemical or electrical risk, etc.) will depend on the type of practice to be done. In that case, the teacher will inform of the necessity of specific EPI.

Not bringing the EPI's described or not fulfilling the norms of general security that are detailed below imply that the student can not access to the laboratories or have to go out of them. The no realisation of the practices for this reason imply the **consequences in the evaluation** of the subject that are described in this course guide.

- Keep the place of realisation of the practices clean and tidy. The table of work has to be free from backpacks, folders, coats...
- No short trousers or short skirts are allowed in the laboratory.
- Closed and covered footwear is compulsory in the laboratory.
- Long hair needs to be tied.

- Keep the laboratory gown laced in order to be protected from spills of chemicals.
- Bangles, pendants or wide sleeves are not allowed as they can be trapped.
- Avoid the use of contact lenses, since the effect of the chemical products is much bigger if they enter between the contact lense and the cornea. Protection over-glasses can be purchased.
- No food or drink is allowed in the laboratory.
- It is forbidden to smoke in the laboratories.
- Wash your hands whenever you have contact with a chemical product and before going out of the laboratory.
- Follow the instructions of the teacher and of the laboratory technicians and ask for any doubt on security.

For further information, you can check the following document of the *Servei de Prevenció de Riscos Laborals de la UdL*: <http://www.sprl.udl.cat/alumnes/index.html>

## Learning objectives

- Review basic concepts of Chemistry (Theme 1)
- Understand the internal structure of the atoms, their electronic configuration and the information contained in the Periodic Table (Theme 2 and Theme 3)
- Understand the concept of chemical bonding; Predict the type of link in any substance based on the various link theories: Lewis, Link Valencia (Hybridization) and Molecular Orbitals (Theme 4)
- Compile the acid-base balances (Topic 5).
- Understand the precipitation balances (Topic 6).
- Understand the oxidation-reduction balance (Unit 7).

## Competences

### Basic

B01 That students have demonstrated to possess and understand knowledge in an area of study that starts from the base of general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that imply knowledge coming from the vanguard of his field of study.

B02 That students know how to apply their knowledge to their work or vocation in a professional manner and possess the skills that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

B03 That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical issues.

### General

CG3. Synthesize basic and technological subjects, which enable them to learn new methods and theories, and provide them with versatility to adapt to new situations.

CG4 Solve problems with initiative, make decisions, creativity, critical reasoning and communicate and transmit knowledge, skills and abilities in the field of Industrial Chemical Engineering.

CG10. Work in a multilingual and multidisciplinary environment.

### Specific

CE4. Apply the principles of fundamental knowledge of general chemistry, organic and inorganic chemistry and their applications in engineering.

### Transversal

CT4. Apply basic knowledge of entrepreneurship and professional environments.

CT5. Apply essential notions of scientific thinking.

## Subject contents

### 1. Introduction to Chemistry

- 1.1 Chemical substances and reactions
- 1.2 Atomic and molecular masses
- 1.3 Centesimal composition
- 1.4 Concept of mole

- 1.5 Stoichiometric calculations
- 1.6 Pure liquids and solutions
- 1.7 Gases

## 2 i 3. Atomic structure

- 2.1 Atomic theory
- 3.1 Periodic Table
- 3.2 Periodic properties

## 4. Link chemical

- 4.1 Chemical link
- 4.2 Ionic link
- 4.3 Covalent link
- 4.4 Valencia Link Theory
- 4.5 Theory of Molecular Orbitals

## 5. Acid-base balance

- 5.1 L'equilibrium and the principle of Le Chatelier
- 5.2 Concept of Bronsted and Lewis acid and base.
- 5.3 Water autoionization and pH scale
- 5.4 Acid and base ionization constants
- 5.5 Reactions of acids and bases, salts and hydrolysis
- 5.6 Polyprotic acids and bases
- 5.7 Effect of the common ion
- 5.8 Regulatory solutions

## 6. Solubility balance

- 6.1 Solubility of salts in water
- 6.2 Solubility equilibria and solubility product constant,  $K_{ps}$ .
- 6.3 Dissolution of precipitates

## 7. Redox Balance

- 7.1 Oxidation and reduction reactions. Oxidation numbers.
- 7.2 Redox equalization.

## Methodology

The development of the subject will be in person/on line according to the timetable.

The methodological axes of the subject will be divided into:

1. Theoretical lecture sessions where the professor will present theoretical contents necessary for the acquisition of knowledge and for the correct development of the practical sessions.
2. Problem sessions where the teacher will do some examples, but where students will take an active part of their learning process by working in small groups or individually.
3. Practical sessions in the laboratory where the students will work in groups in practices related to the thematic developed in the theoretical sessions. The practical sessions are mandatory in order to pass the evaluation of this subject.

In addition, students have the responsibility to reinforce their knowledge independently, based on the didactic material provided or recommended by the teacher.

## Development plan

| Week  | Methodology  | Topic         | On-site hours | Independent work hours |
|-------|--|---------------|---------------|------------------------|
| 1-2   | Class activity and problem classes<br>Practical activity | Topic 1       | 6             | 12                     |
| 3-6   | Master classes and problem classes                       | Topic 2 and 3 | 12            | 18                     |
| 7-9   | Master classes and problem classes<br>Practical activity | Topic 4       | 12            | 18                     |
| 10-12 | Master classes and problem classes<br>Practical activity | Topic 5       | 12            | 18                     |
| 12-14 | Master classes and problem classes                       | Topic 6       | 12            | 12                     |
| 15    | Master classes and problem classes                       | Topic 7       | 12            | 12                     |

## Evaluation

The subject will be evaluated according to the continuum assesment.

The final grade will be calculated according to:

|                         |      |
|-------------------------|------|
| Follow-up activities:   | 20 % |
| Evaluatory activities:: | 50 % |
| Practices:              | 30 % |

If a student can not follow (justifiably) the continuum assesment of the subject, can apply (according to the established terms) for an alternative evaluation.

## Bibliography

Basic Bibliography:

Peter Atkins y Loretta Jones, "*Principios de química*", 3ª Ed., Editorial Médica Panamericana, Buenos Aires, 2006. R. Petrucci, W.S. Harwood y F.G. Herring, "*Química general*", 8ª Ed, Pearson Educación, Madrid, 2003

Kenneth W. Whitten, Raymond E. Davis i M. Larry Peck. "*Química general*". 5ª. Madrid, McGraw-Hill Internacional de España. S.A., 1999. ISBN 8448113861.

Masterton, William L., Hurley, Cecile N. "*Química: principios y reacciones*". 4ª. Madrid: Thomson, 2003. ISBN 8497321006.

Reboiras, M.D. "*Química: la ciencia básica*". Madrid: Thomson, 2006. ISBN 8497323475.

Vinagre Jara, Francisco "*Fundamentos y problemas de química*". Madrid: Alianza Editorial, 1989. ISBN 842068130X.

Sales i Cabré, Joaquim. "*Introducció a la nomenclatura química: inorgànica*"

## Complementary bibliography:

Moore, John [et al.]. *El mundo de la Química: conceptos y aplicaciones*. 2ª. México: Pearson Educación, 2000. ISBN 968444365X.

Vale Parapar, José [et al.]. *Problemas resueltos de química para ingeniería*. Madrid: Thomson, 2004. ISBN 8497322932.

F. Burriel Martí, F. Lucena Conde, S. Arribas Jimeno, J. Hernández Méndez. *Química analítica cualitativa*. 18. Madrid: Paraninfo, 2001. ISBN 8428312532.

Skoog, Douglas A., West, Donald H., Holler, F. James, Crouch, Stanley R. *Fundamentos de química analítica*. 8. Madrid: Thomson, 2005. ISBN 8497323335.

Harris, Daniel C. *Quantitative Chemical Analysis*. 5. New York: W.H. Freeman and Company, 1999. ISBN 0716728818.

Rodney J. Sime. *Physical Chemistry: methods, techniques and experiments*. 1990. Philadelphia: Saunders College Publishing, 1990. ISBN 0030094992.

Altres materials didàctics s'aniran penjant al Campus Virtual: <http://cv.udl.cat>