



## Course guide 820010 - Q - Chemistry

Last modified: 14/06/2023

**Unit in charge:** Barcelona East School of Engineering  
**Teaching unit:** 713 - EQ - Department of Chemical Engineering.

**Degree:** BACHELOR'S DEGREE IN BIOMEDICAL ENGINEERING (Syllabus 2009). (Compulsory subject).  
BACHELOR'S DEGREE IN ELECTRICAL ENGINEERING (Syllabus 2009). (Compulsory subject).  
BACHELOR'S DEGREE IN ENERGY ENGINEERING (Syllabus 2009). (Compulsory subject).  
BACHELOR'S DEGREE IN INDUSTRIAL ELECTRONICS AND AUTOMATIC CONTROL ENGINEERING (Syllabus 2009). (Compulsory subject).  
BACHELOR'S DEGREE IN MECHANICAL ENGINEERING (Syllabus 2009). (Compulsory subject).  
BACHELOR'S DEGREE IN MATERIALS ENGINEERING (Syllabus 2010). (Compulsory subject).

**Academic year:** 2023    **ECTS Credits:** 6.0    **Languages:** Catalan, Spanish, English

### LECTURER

---

**Coordinating lecturer:** ANTONIO GÁMEZ LÓPEZ

**Others:**

Primer quadrimestre:

AURELIO CALVET TARRAGONA - Grup: M33, Grup: M51, Grup: M54, Grup: M71, Grup: M74, Grup: M83, Grup: M84, Grup: M91, Grup: M92, Grup: T14, Grup: X24  
JOAN DE PABLO RIBAS - Grup: M41, Grup: M42, Grup: M43, Grup: M44  
EVA GALLEGRO PIÑOL - Grup: M61, Grup: M62, Grup: M63, Grup: M64  
ANTONIO GÁMEZ LÓPEZ - Grup: M71, Grup: M72, Grup: M73, Grup: M74, Grup: M91, Grup: M92, Grup: M93, Grup: M94, Grup: X11, Grup: X12, Grup: X13, Grup: X14  
CLAUDIA GARCIA MINTEGUI - Grup: M12, Grup: T12, Grup: T13, Grup: X13, Grup: X14  
ORIOL GIBERT AGULLO - Grup: M51, Grup: M52, Grup: M53, Grup: M54  
FRANCISCO JAVIER GIMENEZ IZQUIERDO - Grup: M31, Grup: M32, Grup: M33, Grup: M34, Grup: M41, Grup: M42  
NEUDYS DEL VALLE GONZÁLEZ GÓMEZ - Grup: T11, Grup: T12, Grup: T13, Grup: T14  
MEHREZ HERMASSI - Grup: M11, Grup: M12  
JOSE IGNACIO IRIBARREN LACO - Grup: X21, Grup: X22, Grup: X23, Grup: X24  
ESTHER ORTEGA ALVAREZ - Grup: M31, Grup: M32, Grup: M43, Grup: M52, Grup: M61, Grup: M62, Grup: M72, Grup: M82, Grup: M93, Grup: X23  
SOFIA PAULO MIRASOL - Grup: M63, Grup: M64  
MANUEL RIVAS CAÑAS - Grup: M81, Grup: M82, Grup: M83, Grup: M84, Grup: X21  
VIRGINIA SAN ANTONIO BENITO - Grup: M33, Grup: M34, Grup: M44, Grup: M53, Grup: M73, Grup: M81, Grup: M94, Grup: X11, Grup: X12, Grup: X22

Segon Quadrimestre:

Armelin Diggroc, Elaine Aparecida  
Del Valle Mendoza, Luis Javier  
Farran Marsa, Adriana  
Florido Perez, Antonio  
Gallego Piñol, Eva  
Gámez López, Antonio  
Gimenez Izquierdo, Francisco Javier  
Pérez Madrigal, Maria Del Mar  
Rivas Cañas, Manuel  
Sánchez Jiménez, Margarita  
Scarazzato, Tatiana



## DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

---

### Specific:

5. Understand the fundamental principles of general, organic and inorganic chemistry and apply them in engineering.

### Transversal:

2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 1. Planning oral communication, answering questions properly and writing straightforward texts that are spelt correctly and are grammatically coherent.

## TEACHING METHODOLOGY

---

L'assignatura consta de classes en les que el professorat presenta els objectius d'aprenentatge relacionats amb els diferents continguts i posteriorment s'apliquen en la resolució d' exemples pràctics. S'afavoreix la participació activa de l'estudiantat durant la resolució dels casos pràctics, proposant un bon nombre de problemes numèrics i es motiva mitjançant propostes de casos reals relacionats amb l'àmbit de la química.

Durant el curs se'ls proporciona material i eines d'aprenentatge per tal d'orientar i guiar a l'alumnat en el seu procés d'aprenentatge i que pugui consolidar els coneixements sobre química que va assolint al llarg del curs.

## LEARNING OBJECTIVES OF THE SUBJECT

---

Each student to acquire basic scientific knowledge on the subject of Chemistry.

Introduce students to the methodologies and tools necessary to achieve resolution of problems encountered in the various topics of the course.

That each student knows or problem solving exercises in all subjects of the course.

Educating students in the realization of a safe working in the laboratory.

Each student is able to work efficiently in the laboratory.

Educating students on the importance of independent work to assimilate concepts, solve exercises and critically analyze the result.

Know that each student seeking information, synthesize it, and assimilate concepts

## STUDY LOAD

---

Type	Hours	Percentage
Self study	90,0	60.00
Hours small group	7,5	5.00
Hours large group	52,5	35.00

**Total learning time:** 150 h

## CONTENTS

### CHAPTER 1- CHEMICAL EQUILIBRIUM

**Description:**

1. Concentration and stoichiometry
2. Chemical equilibrium
3. Enthalpy, entropy and free energy
4. Equilibrium constant
5. Le Chatelier Principle

**Specific objectives:**

1. To describe the concept of chemical equilibrium
2. To describe the equilibrium constant
3. To determine the variation of the equilibrium constant with variation in total pressure, volume or concentration

**Full-or-part-time:** 15h

Theory classes: 6h

Self study : 9h

### CHAPTER 2- ACID-BASE EQUILIBRIA

**Description:**

1. Definition of acid and base. Brønsted and Lowry theory.
2. Strength of acids and bases. pH.
3. Determination of the pH of monoprotic or diprotic acids. Mass and charge balances. Logarithmic diagrams.
4. Mixtures of acids and bases. Buffer solutions.

**Specific objectives:**

1. To identify when a chemical species is acidic or alkaline.
2. To identify when an acid or a base is strong.
3. To determine the pH of acids or bases by using mass and charge balances and logarithmic diagrams.
4. To determine the pH of mixtures of acids and bases.
5. To identify when a solution buffers the pH.

**Full-or-part-time:** 25h

Theory classes: 10h

Self study : 15h

### CHAPTER 3- SOLUBILITY

**Description:**

1. Solubility and solubility product
2. Precipitation and fractional precipitation
3. Common-ion solubility
4. Solubility in the presence of acid-base parallel reactions

**Specific objectives:**

1. To identify the solubility of a solid
2. To determine the solubility of non-soluble solids
3. To determine the solubility of non-soluble solids if there is a common-ion effect
4. To determine the solubility of non-soluble solids in systems with acid-base parallel reactions

**Full-or-part-time:** 20h

Theory classes: 8h

Self study : 12h



## CHAPTER 4- REDOX REACTIONS

### Description:

1. Semi-reactions and redox reactions
2. Standard reduction potential.  $p_e$  and equilibrium constant
3. Nernst equation
4. Metals corrosion
5. Latimer, Frost and Pourbaix diagrams
6. Batteries and electrolysis

### Specific objectives:

1. To identify oxidizing and reduction reactions as well as oxidizing and reducing species
2. To determine equilibrium constants of redox reactions
3. To calculate  $p_e$  values by using Nernst equation
4. To draw and to interpret Latimer, Frost and Pourbaix diagrams

**Full-or-part-time:** 30h

Theory classes: 12h

Self study : 18h

## CHAPTER 5- ATOMIC STRUCTURE AND PERIODIC TABLE

### Description:

1. Origin of the chemical elements
2. Atomic number, Mass number, isotopes
3. Schrödinger Equation. Quantum numbers. Electronic configuration. Pauli Exclusion principle, Aufbau Principle, Hund's Rule.
4. Periodic table
5. Oxidation state of the elements
6. Periodic properties.

### Specific objectives:

1. To deduce the electronic configuration of elements and ions
2. To deduce the oxidation state of the elements from the electronic configuration
3. To compare periodic properties from different elements

**Full-or-part-time:** 22h 30m

Theory classes: 9h

Self study : 13h 30m

## CHAPTER 6- THE CHEMICAL BOND

### Description:

1. Lewis theory: the octet rule. Lewis structures. Lewis acids and bases
2. Formal charge associated to an atom. Resonance.
3. VSEPR theory
4. Polarity of a bond and of a molecule
5. Intermolecular forces

### Specific objectives:

1. To determine the Lewis structure of a molecule, including the formal charge of the atoms
2. To deduce the geometry of a molecule from the Lewis structure
3. To deduce the polarity of a molecule depending on the different chemical bonds

**Full-or-part-time:** 18h 45m

Theory classes: 7h 30m

Self study : 11h 15m



## LABORATORY

### Description:

There will be three different laboratory activities, which will involve the concepts learned during the course

**Full-or-part-time:** 18h 45m

Laboratory classes: 7h 30m

Self study : 11h 15m

## GRADING SYSTEM

The final mark will consist of three inputs:

- 1) Partial exam: EP
- 2) laboratory: Elab
- 3) Final exam: EF

The course is evaluated from:

$$NF = 0.15 * Elab + 0.25 * EP + 0.60 * EF$$

Laboratory sessions are mandatory, in case of absence to any of the sessions, the final qualification of the course will be NP (not presented).

Re-evaluation exam will account for EP and EF

The students will be able to access the re-assessment test that meets the requirements set by the EEBE in its Assessment and Permanence Regulations

(<https://eebe.upc.edu/ca/estudis/normatives-academiques/documents/eebe-normativa-avaluacio-i-permanencia-18-19-aprovat-je-2018-06-13.pdf>)

## EXAMINATION RULES.

In all the written exams will be necessary to bring a pocket calculator . In any case you can not have any electronic devices with capabilities to transfer data, neither notes not formulae summaries .

## BIBLIOGRAPHY

### Basic:

- Ralph H. Petrucci ... [et al.]. Química general : principios y aplicaciones modernas [on line]. 11<sup>a</sup> ed. Madrid [etc.]: Pearson Prentice Hall, cop. 2017 [Consultation: 09/06/2020]. Available on: [http://www.ingebook.com/ib/NPcd/IB\\_BooksVis?cod\\_primaria=1000187&codigo\\_libro=6751](http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=6751). ISBN 9788490355343.
- Aguilar Sanjuán, Manuel. Introducción a los equilibrios iónicos. 2<sup>a</sup> ed. Barcelona [etc.]: Reverté, 1999. ISBN 8429175504.

### Complementary:

- Brown, Theodore L. Química : la ciencia central [on line]. 12<sup>a</sup> ed. Mèxico [etc.]: Pearson, 2014 [Consultation: 29/04/2020]. Available on: [http://www.ingebook.com/ib/NPcd/IB\\_BooksVis?cod\\_primaria=1000187&codigo\\_libro=4690](http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=4690). ISBN 9786073222358.
- Casabó i Gispert, Jaume. Estructura atómica y enlace químico [on line]. Barcelona [etc.]: Reverté, cop. 1996 [Consultation: 29/04/2020]. Available on: [http://www.ingebook.com/ib/NPcd/IB\\_BooksVis?cod\\_primaria=1000187&codigo\\_libro=1455](http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=1455). ISBN 9788429193343.

## RESOURCES

### Other resources:

During the course, different documents related to the subjects will be found in the ATENEA platform.