# COURSE DATA

| Data Subject | |
|---|---|
| **Code** | 33068 |
| **Name** | Chemistry |
| **Cycle** | Grade |
| **ECTS Credits** | 6.0 |
| **Academic year** | 2017 - 2018 |

**Study (s)**

| Degree | Center | Acad. year | Period |
|---|---|---|---|
| 1100 - Degree in Biology | Faculty of Biological Sciences | 1 | First term |

**Subject-matter**

| Degree | Subject-matter | Character |
|---|---|---|
| 1100 - Degree in Biology | 2 - Chemistry | Basic Training |

**Coordination**

| Name | Department |
|---|---|
| GAVIÑA COSTERO, PABLO | 325 - Organic Chemistry |

# SUMMARY


## SUBJECT INTRODUCTION

The subject Chemistry of the Degree in Biology (1st year, 6 ECTS, 1st) has the following fundamental objectives:

- Acquisition of the minimum knowledge about the chemical elements and their combinations. Associate the existing relationship between Chemistry and Biology.
- Focus on the active resolution of the current issues related with Biology.
- Achieving an adequate chemical background in order to understand other related items through the degree in depth.

Upon completion of the lecture, the student is expected to be able to explain, in a comprehensive manner, chemical phenomena and basic processes interacting with the field of Biology.

The subject Chemical Basis, in addition to the theoretical contents, also has a mandatory experimental part, corresponding to the laboratory practices (see below).

**SITUATION IN THE SYLLABUS CONTEXT**

Chemical Basis is a 6 ECTS mandatory subject within the Degree in Biology which has a basic education character. It is taught during the first semester.

By including this subject in the Degree in Biology the following objectives are pursued:

- Providing a necessary tool in other matters, belonging to the Degree.
- Helping to acquire the generic and specific competences necessary for the development of a future career.
- Acquiring logic-deductive skills by means of the study of characteristic contents in Chemistry.

**SUPPORT RESOURCES**

At the beginning of the Course, general instructions for tracking the lecture and for active participation will be given.

Likewise, additional material for tracking the lecture will be available for the students, in the *aula virtual*.

## PREVIOUS KNOWLEDGE

### Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

### Other requirements

In order to attend the Chemistry Lecture, no pre-requisite is demanded. Nevertheless, reviewing all the related studies along the secondary school is strongly recommended.

As a support for the student, undertaking some Chemistry zero course which may be available open on-line is also recommended.

## OUTCOMES

### 1100 - Degree in Biology

- Capacidad para trabajar en grupo a la hora de enfrentarse a situaciones problemáticas de forma colectiva.
- Habilidad para argumentar desde criterios racionales.

- Capacidad para realizar una exposición oral de forma clara y coherente.
- Capacidad de construir un texto escrito comprensible y organizado.
- Capacidad para obtener la información adecuada con la que poder afrontar nuevos problemas científicos que se le planteen.
- Saber aplicar los conceptos químicos teóricos a casos prácticos de índole biológica.
- Manejar instrumentos de medida, unidades, precisión y error.
- Conocer los principios químicos sobre la estructura del átomo.
- Manejar la nomenclatura química y las reglas de formulación.
- Saber determinar las cantidades de materia implicadas en una reacción química.
- Saber obtener el orden y la constante de velocidad de reacciones químicas sencillas a partir de datos experimentales.
- Comprender los criterios de espontaneidad y equilibrio en reacciones químicas.
- Conocer las propiedades de los equilibrios ácido-base y redox.
- Conocer la estructura y reactividad de los compuestos orgánicos.

## LEARNING OUTCOMES

Upon completion of the lecture, the student is meant to able to:

- Comprehensively explain basic chemical phenomena and processes that interact with Biology.
- Describe the structure, physical-chemical properties and reactivity of the elements and compounds involved in biochemical cycles.
- Operate with the basic instrumentation of a chemistry laboratory
- Interpretation of the empirical results in chemistry.

In addition, the course is oriented to the student to achieve the following cross competences and skills:

- Self-learning ability.
- Problem resolution and decision making ability.
- Creativity for the generation of ideas.
- Scientific and technologic information management ability.
- Analysis, organization and planning ability.
- Development of scientific communication skills.
- Scientific and critic reasoning.
- Team-working ability.
- Knowledge of the multimedia and Internet applications in the field of learning.

## DESCRIPTION OF CONTENTS

### 1. Matter Structure and Chemical Bond

Properties, classification and structure of Matter. Atoms and molecules. The mole concept. Ionic and covalent bonds. Lewis structures. Resonance structures.Forms of molecules: the VSEPR model. Polar covalent bonds. Polar and nonpolar molecules.

### 2. Thermochemistry. Chemical Equilibrium

Internal Energy, Heat, and Work. Heat of reaction: Enthalpy. Spontaneity of the reactions. Entropy and Gibbs Free Energy. General rule of the chemical equilibrium. Mass action law. Equilibrium constants.

### 3. Solutions. Acids and bases. Solubility. Precipitation and redox

The concept solution. Diluted solutions. Equilibrium between ionic solids and their saturated solutions. Solubility and solubility product constant. Definition of acids and bases.. Water autoionization. pH scale. Acids and bases strength. Buffer solutions. Electrochemical systems. Redox reactions. Biological implications.

### 4. Structure and bonding in organic molecules.

Valence Bond Theory: hybrid orbitals. Simple and multiple links. Molecular Orbitals Theory: Diatomic molecules.

### 5. Functional groups. Organic nomenclature

Functional groups: concept and classification. Representation of organic compounds: empirical, molecular and structural formula. Organic chemistry nomenclature: IUPAC rules.

### 6. Isomery: Concept. Clasification. Conformacional analysis

Concept of isomerism. Classification. Conformational analysis: ethane, butane and cyclohexane. Stereoisomerism. (R)(S) nomenclature. Compounds bearing one or two chiral centers.

### 7. Intermolecular forces

Bonding weaker than covalent. Van der Waals forces. Dipolar interactions. Hydrogen bonds. Influence of the intermolecular forces in the physical properties of organic compounds. Structural effect in the properties of organic compounds.

### 8. Reactivity of the organic compounds

The concepts of electrophile and nucleophile in organic chemistry. Homolytic and heterolytic reactions. Common types of organic reactions: substitution, elimination, addition and oxidation reactions.

### 9. Practice: Laboratory essays

1. Laboratory introduction. Safety rules.
2. Techniques introduction. Accuracy and precision. Preparation of solutions.
3. Acid-base equilibrium study: volumetric titrations. Indicators.
4. Soft acids and strong acids potentiometric titration. Measure of pH.
5. Qualitative study of several reactions: colorimetric assays.
6. Molecular models: stereochemistry. Chemistry laboratory exam.

## WORKLOAD

| ACTIVITY | Hours | % To be attended |
|---|---|---|
| Theory classes | 35,00 | 100 |
| Laboratory practices | 15,00 | 100 |
| Classroom practices | 7,00 | 100 |
| Tutorials | 3,00 | 100 |
| Study and independent work | 35,00 | 0 |
| Preparation of evaluation activities | 16,50 | 0 |
| Resolution of case studies | 13,50 | 0 |
| Resolution of online questionnaires | 25,00 | 0 |
| **TOTAL** | **150,00** | |

## TEACHING METHODOLOGY

### METHODOLOGY AND LEARNING ACTIVITIES

For the course Chemistry a methodology leant on TIC will be applied. This will be based upon learning activities distributed as autonomous working and interacting time with the Professor.

The course includes a theoretical as well as a practical part. The activities are organized in for fields: theoretical classes, problems solving classes, tutorships and laboratory practices.

The learning activities will be as follows:

*Theoretical part*

- Searching on educational material (Basic Texts, materials on the Aula Virtual, recommended bibliography, Internet resources, etc.)
- Studying the theoretical issues on the Basic Texts
- Solving problems
- Continuous assessment texts
- Activities proposed by the Professor
- Learning for the assessment tests

*Experimental part*

- Setting up the laboratory plans, available at the Aula Virtual
- Getting information about the handling of laboratory materials and products (safety sheets)
- Laboratory experiments
- Data processing and results discussion
- Preparation of the laboratory journal

## EVALUATION

The academic performance of the student and the final grade of the course will be due, in a weighted manner, regarding the average obtained in each of the parts evaluated. All grades will be based in an absolute score over 10 points, according to the established scale in RD 1125/2003. These criteria will be kept at the second examination session.

The following parts will be considered and evaluated:

**1. Direct assessment of the Professor** (5 %)

In this assessment will be considered several aspects. Among them, we can highlight the following:

- In-person assistance to the classes with an active participation
- Progression in the use of the proper language of organic chemistry
- Problem resolution and questions
- Critical spirit

**2. Single assessment test** (65 %)

A clasroom test will take place during the january exams period; those students who do not pass this test will have a second test in July. The questions will deal with issues thorough the program.. The assessment will weigh up to 6.5 points on the final mark. The exam could be revised upon requirement to the Professor.

**3. Practicum** (20 %)

They will be performed in the laboratory. See the corresponding section. The assessment of the practices will weigh up to 2.0 points on the final mark.

**4. Interdisciplinary work (Biograd)** (10 %)

Consisting on a group work which will add up to 1.0 point to the final mark. Along this activity, the necessary social skills to prove the capacity to work in a team will be developed; specifically to construct an organized written communication after collecting the suitable information. Alternatively, the student can choose any other transversal activity, approved by the CAT, within the framework of an educational innovation project.

**PRACTICUM**

Student in this course must attend mandatory practices which will take place in the laboratory and will last approximately 15 hours. The evaluation of the practice laboratory will be performed by means of a practice exam at the end of the process.

The plans for the practices are available at the Aula Virtual.

The weight of all the aforementioned parts in the final mark will be performed, as long as the qualification obtained in the single assessment test and the practice exam is not inferior to 4,5 points.

Any student, who needs to attend the second examination session, will only conduct the classroom test; the marks obtained in the practicum, the direct evaluation of the professor and the interdisciplinary activity will be kept.

## REFERENCES

### Basic

- CHANG, R. Química. 10ª edició. Ed. McGraw Hill, 2010.
- PETRUCCI, Ralph H. Química General: Principios y aplicaciones modernas 10ª edició. Ed. Pearson Educación, S. A., 2011.
- ATKINS, P. y JONES, L. Principios de Química. Los caminos del descubrimiento. 3ª edición. Ed. Panamericana, 2006
- COLECCION BASE UNIVERSITARIA, Iniciación a la química superior. Ed. Anaya.
- ChemBioOffice Ultra, PerkinElmer (CambridgeSoft)
  Amplia selección de aplicaciones y funcionalidades que permite a químicos y biólogos dibujar, formular, modelar y editar estructuras moleculares químicas y biológicas.

## Additional

- En laula virtual daquesta assignatura sindicarà una bibliografia més extensa de textos de Química General i de Laboratori.