COURSE DATA

Data Subject

Code	33068
Name	Chemistry
Cycle	Grade
ECTS Credits	6.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1100 - Degree in Biology	Faculty of Biological Sciences	1	First term
1106 - Degree in Biology	Faculty of Biological Sciences	1	First term

Subject-matter

Degree	Subject-matter	Character
1100 - Degree in Biology	2 - Chemistry	Basic Training
1106 - Degree in Biology	2 - Química	Basic Training

Coordination

Name	Department
ESCORIHUELA FUENTES, JORGE	325 - Organic Chemistry
GONZALEZ BEJAR, MARIA	325 - Organic Chemistry

SUMMARY

FOR STUDENTS ENROLLED WITH THE 2010 STUDY PLAN (OLD STUDY PLAN, IN THE PROCESS OF EXTINCTION):

DUE TO THE IMPLEMENTATION OF THE NEW CURRICULUM OF THE DEGREE IN BIOLOGY, THIS SUBJECT IS IN THE PROCESS OF EXTINCTION AND, THEREFORE, IS OFFERED ONLY WITHOUT TEACHING. THIS MEANS THAT NO FACE-TO-FACE TEACHING ACTIVITY WILL BE ASSOCIATED AND THAT THE EVALUATION OF THE SUBJECT WILL BE CARRIED OUT ONLY THROUGH A THEORETICAL-PRACTICAL EXAM.

STUDENTS WHO DO NOT PASS IT IN ANY OF THE CALLS OF THE 2023-24 OR 2024-25 ACADEMIC YEARS WILL BE OBLIGED TO ADAPT TO THE NEW PLAN TO CONTINUE THEIR UNDERGRADUATE STUDIES IN BIOLOGY.

The subject of Chemistry in the Biology Degree (first year, 6 ECTS credits, first semester) has the following fundamental objectives:

• Acquire basic knowledge about the behavior of chemical elements and their combinations.

• Associate the relationship between Chemistry and Biology.

• Guide towards actively solving different problems existing in the field of Biology today.

• Establish a chemical foundation to delve into other related topics throughout the degree.

Upon completion of the subject, the student will be able to explain in a comprehensible manner basic chemical phenomena and processes that interact with the field of Biology.

In addition to the theoretical component, the subject of Chemistry also includes a mandatory experimental part, which corresponds to the laboratory practices of the subject (see practical section).

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 them 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 online 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.

1106 - Degree in Biology

- Students must have acquired knowledge and understanding in a specific field of study, on the basis of general secondary education and at a level that includes mainly knowledge drawn from advanced textbooks, but also some cutting-edge knowledge in their field of study.
- Students must be able to apply their knowledge to their work or vocation in a professional manner and have acquired the competences required for the preparation and defence of arguments and for problem solving in their field of study.
- Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.
- Apply principles of physics, chemistry and geology to the field of biology.
- Design and conduct experiments by using scientific techniques and instruments appropriately and complying with laboratory safety regulations.
- Organise, plan and manage information in a manner that allows the individual to analyse, synthesise and develop critical reasoning that can be applied to solve problems, make decisions and carry out work.
- Use scientific language, both oral and written, and be able to adapt the register to the target audience and/or readers. Use the most common foreign languages in each discipline as a vehicle for communication in a globalised system.

LEARNING OUTCOMES

- Properly use basic measuring instruments.
- Solve theoretical and practical chemical exercises.
- Solve numerical acid-base problems using expressions of constants and material and charge balances.
- Prepare buffer solutions from their components.
- Balance oxidation-reduction reactions.
- Use redox potential tables to determine whether a reaction will occur between two species.
- Predict the acid-base behavior of organic molecules.
- Formulate simple organic molecules.

Distinguish different types of organic reactions from a mechanistic perspective.

DESCRIPTION OF CONTENTS

1. Matter structure and chemical bonds

Properties, classification, and structure of matter. Atoms and molecules. Concept of a mole. Stoichiometry of chemical reactions. Ionic and covalent bonding. Lewis structures. Resonance structures. Molecular geometry: the VSEPR model. Polar covalent bonds. Polar and nonpolar molecules.

2. Structure and bonding in organic molecules

Valence bond theory: hybrid orbitals. Single and multiple bonds. Molecular orbital theory: diatomic molecules.

3. Classification of organic compounds

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

4. Thermochemistry and chemical equilibrium

Reaction enthalpy: Heat of reaction. Spontaneity of reactions. Entropy and Gibbs free energy. General condition of chemical equilibrium. The law of mass action. Equilibrium constants. Types of equilibria.

5. Acid-base equilibrium

Definitions of acids and bases. Autoionization of water. pH scale. Strength of acids and bases. Buffer solutions. Acid-base reactions in organic compounds. Biological implications of acid-base reactions.

6. Solubility and redox equilibrium

Precipitation equilibria. Solubility and solubility product. Common ion effect. Redox reactions. Electrochemical systems. Oxidation-reduction reactions in organic compounds. Biological implications of redox reactions.

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: solubility and melting points.

8. Isomerism in Organic Chemistry

Concept of isomerism and classification. Conformational analysis of alkanes: ethane, propane, butane. Conformational analysis of substituted cyclohexanes. Stereoisomerism in cycloalkanes. Enantiomers and the tetrahedral carbon. (R) and (S) nomenclature. Compounds with one and two chiral centers. Stereoisomerism in alkenes. (E) and (Z) nomenclature.

9. Reactivity of organic compounds

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

10. 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. Oxidation-reduction (redox) reactions. Galvanic cells.
5. Qualitative study of several reactions: colorimetric assays.
6. Molecular models: stereochemistry. Chemistry laboratory exam

11. Contents of the Chemistry subject of the 2010 study plan (old plan, to be extinguished). Only applicable to students enrolled in the old plan, who do not have face-to-face teaching.

1. Matter structure and chemical bonds
2. Termochemistry. Chemical equilibrium
3. Solutions. Acids and bases. Solubility. Precipitation and Redox.
4. Structure and bonding in organic molecules
5. Functional groups. Organic nomenclature
6. Isomerism in Organic Chemistry
7. Intermolecular forces

8. Reactivity of organic compounds
9. Practice. Laboratory essays

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
Development of individual work	9,00	0
Study and independent work	81,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

NOT APPLICABLE FOR STUDENTS ENROLLED WITH THE 2010 STUDY PLAN (OLD STUDY PLAN, IN THE PROCESS OF EXTINCTION) DUE TO THE IMPLEMENTATION OF THE NEW STUDY PLAN: SEE THE SUMMARY SECTION

The development of the subject is structured around the following activities:

• Expository lectures: The instructor delivers lectures to present and explain the theoretical concepts of the subject.

• Participatory and/or debate classes: These classes encourage active participation and discussion among students, fostering critical thinking and deeper understanding of the topics.

• Problem-solving based learning: Students engage in exercises and problem-solving activities to apply the knowledge acquired and develop their analytical skills.

• Oral presentations and/or posters: Students may be assigned to give oral presentations or create posters to present their research or findings related to the subject.

• Laboratory practical classes: Students attend practical laboratory sessions where they perform experiments related to the subject, gaining hands-on experience and reinforcing theoretical concepts.

EVALUATION

NOT APPLICABLE FOR STUDENTS ENROLLED WITH THE 2010 STUDY PLAN (OLD STUDY PLAN, IN THE PROCESS OF EXTINCTION) DUE TO THE IMPLEMENTATION OF THE NEW STUDY PLAN: SEE THE SUMMARY SECTION

The student's academic performance and final grade for the subject will be determined, in a weighted manner, according to the percentages shown for each evaluated section.

All grades will be based on an absolute score out of 10 points, following the scale established in RD 1125/2003. This criterion will be maintained in all exam sessions.

The different sections that will be evaluated are as follows:

Direct evaluation by the instructor (10%): This evaluation will take into account various aspects, including:

Attendance and reasoned and clear participation in discussions.

Progress in the use of the language characteristic of organic chemistry.

Problem-solving and raising of questions.

Critical thinking.

Single evaluative test (60%): There will be an in-person test in the January exam session, and for those who do not pass it, there will be another test in the June exam session. The questions will cover the content of the entire program. The evaluation's weighting in the final grade will add up to 6.0 points. Students can approach the responsible instructor for exam review.

Laboratory practices (20%): The practices will be carried out in the General Chemistry laboratory. See the corresponding section. The evaluation of the practices' performance will contribute up to 2.0 points to the final grade.

Interdisciplinary project (Biograde) (10%): Consisting of a group project, which will contribute up to 1.0 point to the final grade. The project will develop the social skills necessary to demonstrate the ability to work in a group and to construct organized written communication after obtaining the appropriate information. Alternatively, another transversal activity endorsed by the CAT, within the framework of an educational innovation project, may be carried out.

LABORATORY PRACTICES:

Students enrolled in this subject are required to complete mandatory laboratory practices, which will take place in the laboratory and have an approximate duration of 15 hours. The evaluation of the practices will be based on the activities performed during each practice and a practical exam at the end. The lab practice guides are available in the Virtual Classroom.

It is not necessary to repeat the practices once they have been passed.

The weighting of the aforementioned sections in the final grade will only be considered if a grade of no less than 4.5 is obtained in the Single Evaluative Test (in-person test) and in the laboratory practices. In the case of having to take the second exam session, the student will only complete the in-person test, and the grades obtained in the subject's lab practices, direct evaluation by the instructor throughout the course, and the interdisciplinary project will be retained.

REFERENCES

Basic

- PETRUCCI, Ralph H. Química General: Principios y aplicaciones modernas. 11ª edició. Ed. Pearson Educación, S. A., 2017.
  ATKINS, P. y JONES, L. Principios de Química. Los caminos del descubrimiento. 5ª edición. Ed. Panamericana, 2021
  BRUICE, P.Y. Fundamentos de Química Orgánica. 3a Ed., Pearson Educación, 2015.
  KLEIN, D. Química Orgánica 2a Ed. Panamericana, 2013.0
  SMITH, J. y VOLLMER-SNARR, H. Organic Chemistry with Biological Topics. 5ª Ed, McGraw Hill, 2017.

Additional

- GONZÁLEZ LUQUE, R. Química general para las ciencias ambientales. 1ª Ed, Publicacions de la Universitat de València, 2011.