VNIVERSITAT DE VALÈNCIA

Course Guide
33940 Organic Chemistry

COURSE DATA

Data Subject	
Code	33940
Name	Organic Chemistry
Cycle	Grade
ECTS Credits	6.0
Academic year	2023 - 2024

Study (s)

Degree	Center	Acad. year	Period
1205 - Degree in Human Nutrition and Dietetics	Faculty of Pharmacy and Food Sciences	1	First term

Subject-matter

Degree	Subject-matter	Character
1205 - Degree in Human Nutrition and Dietetics	8 - Chemistry	Basic Training

Coordination

Name	Department
ZABALLOS GARCIA, ELENA	325 - Organic Chemistry

SUMMARY

Organic Chemistry is taught in the first semester of first year of the degree in Human Nutrition and Dietetics and it is a four-month basic training course. The curriculum consists of 6 ECTS credits in total. This course is intended for students to improve the skills acquired in organic chemistry courses in high school and, in some respects, to complete them. These skills will establish the essential foundations, so that the student can be subsequently addressed into the study of the various aspects of the Chemistry of food related to organic chemistry and basic compounds that form part of their field of study. Being the subject integrated in the degree of Human Nutrition and Dietetics, the approach to chemical phenomena under study, should be specifically focused on the processes related to their specific training.

The course has a mixed character (theoretical and practical) and methodology is based on lectures, seminars, tutorials, and classes addressed to the resolution of questions and problems related with topics presented in lectures. Basic guidelines contained in the program are articulated around the fundamental concepts in organic chemistry. In particular, it is intended that concepts of structure, bonding, functional groups, properties and basic reactivity of special significance organic molecules as components of food will be acquired by students.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

OUTCOMES

1205 - Degree in Human Nutrition and Dietetics

- Conocer los fundamentos químicos de aplicación en nutrición humana y dietética.
- Poder nombrar y formular los compuestos químicos inorgánicos y orgánicos.
- Poder resolver cualquier problema básico relativo a la determinación de las formulas empíricas y moleculares de los compuestos.
- Saber resolver problemas cuantitativos sencillos relativos a los procesos químicos, tanto en el equilibrio como desde un punto de vista cinético.
- Poder explicar de manera compresible fenómenos y procesos relacionados con aspectos básicos de la química.
- Capacidad para construir un texto escrito comprensible y organizado.
- Capacidad para trasmitir ideas, analizar problemas y resolverlos con espíritu crítico, adquiriendo habilidades de trabajo en equipo y asumiendo liderazgo cuando sea apropiado.
- Capacidad para interpretar, valorar y comunicar datos relevantes haciendo uso del lenguaje propio de la química orgánica y de las tecnologías de la información y la comunicación.
- Capacidad para buscar y encontrar conocimientos relacionados con el área, siempre aplicando la capacidad crítica y autocrítica.
- Desarrollar habilidades para poder emprender estudios posteriores, especialmente en el ámbito de la investigación científica y el desarrollo tecnológico.
- Recognise the types of bonds that can occur in organic compounds and the different types of representation of organic molecules.
- Know how to apply the general rules of nomenclature for organic compounds, including stereochemistry.
- Know the different functional groups found in organic molecules and relate the presence of functional groups with the physicochemical properties of organic molecules.
- Know the general reactivity of the most important functional groups found in organic molecules.
- Know the mechanisms of the most important chemical transformations.

- Know the methods most commonly used for obtaining the different types of compounds.
- Be able to relate the presence of functional groups in molecules with their reactivity against different processes (replacement, removal, addition, hydrolysis, oxidation, reduction, etc.).

LEARNING OUTCOMES

- To acquire a solid basic knowledge, so that they can continue a successful learning in later courses.
- To improve or begin in the fundamentals of the discipline such as structure, bonding and properties of the most representative organic molecules, and some keys of their reactivity.
- To acquire the basic terminology of organic chemistry and the required know-how to use it, expressing ideas with the accuracy required in the scientific field and being able to establish relationships between the different concepts and chemical and biological phenomena, extracting the chemical keys from the inherent complexity of the latter.
- To develop the ability to create and solve problems in organic chemistry, as well as to interpret the results.
- To be able to search and select information in the field of chemistry applied to chemical and biochemical phenomena and also to present it properly.
- To enhance skills for teamwork.
- To acquire values and attitudes that should be inherent in scientific activity.

DESCRIPTION OF CONTENTS

1. STRUCTURE AND BONDING IN ORGANIC MOLECULES

Structure of the atom. Atomic orbitals. Ionic and covalent bonds. Lewis structures. Formal charges. Resonance forms. The covalent bonding in organic molecules. Orbital geometry of the hybrid molecules. Polar covalent bond. Polar and nonpolar molecules. dipole moment

2. CHARACTERISTICS OF ORGANIC COMPOUNDS

Functional groups. Nomenclature. Empirical formula and molecular formula. Usual representations of organic compounds

3. INTERMOLECULAR FORCES

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

4. ACIDITY AND BASICIDITY IN ORGANIC COMPOUNDS

Acidic and basic organic compounds. Parameters influencing the acidity and basicity of organic molecules

5. CHEMICAL REACTIONS OF ORGANIC COMPOUNDS

Thermodynamics and reaction kinetics. Concept of reaction mechanism. Reaction intermediates. Polar reactions. Concept of nucleophile and electrophilic carbon. Main types of reactions in organic chemistry: substitution, addition and elimination reactions. Oxidation-reduction reactions.

6. ALKANES AND CYCLOALKANES

Structure and physical properties of alkanes. Conformations. Cycloalkanes. Ring strain. Cyclohexane. Substituted cyclohexanes. Cis/ trans isomerism. Reactions of alkanes

7. ISOMERISM/ ESTEREOISOMERISM

Definition and types of isomerism. Stereoisomers: Conformations and configurations. Chiral molecules. Optical activity. Racemates. Absolute configuration: R/ S nomenclature. Fischer projection. Diastereomers and meso compounds. Resolution of racemates

8. HALOGENATED ORGANIC COMPOUNDS, ALCOHOLS, ETHERS, THIOLS AND SULFIDES

Structure, nomenclature and physical properties of organic halides, alcohols, amines, ethers, thiols and sulfides. Acidity and basicity of alcohols and phenols. Basic concepts of reactivity. Aliphatic nucleophilic substitution reactions. Elimination reaction. Oxidation of alcohols. Acidity and basicity of amines. Amines as nucleophiles. Biological importance of thiols.

9. ALKENES,ALKYNES,CONJUGATED DIENES AND AROMATIC COMPOUNDS

Alkenes and Alkynes: Structure; E/ Z stereoisomers; physical properties. Acidity. Relative stability. Basic concepts of reactivity: addition and oxidation reactions. Conjugated double bonds. Benzene: aromaticity.

10. THE CARBONYLGROUP: ALDEHYDES AND KETONES

Structure of the carbonyl group. Nomenclature and physical properties of aldehydes and ketones. Nucleophilic addition to the carbonyl group. Addition of water and alcohols: hydrates, hemiacetals and acetals. Addition of amines and related compounds. Reactions of oxidation and reduction.

11. SUGARS (CARBOHYDRATES)

Sugars: Structure and classification. Monosaccharides: Cyclic hemiacetal structure. Haworth and chair projections. Disaccharides: the glycosidic bond. Polysaccharides.

12. CARBOXYLIC ACIDS AND THEIR DERIVATIVES

Structure, nomenclature and physical properties of carboxylic acids and their derivatives. Acidity and basicity of carboxylic acids. Reactivity of carboxylic acids and their derivatives: the addition-elimination mechanism. Reduction reactions.

13. FATTY ACIDS AND LIPIDS

Saturated and unsaturated fatty acids. Lipids: Classification. Fats, oils and waxes. Membrane lipids. Steroids.

14. AMINO ACIDS, PEPTIDES AND NUCLEIC ACIDS

Amino acids: structure and classification. Acidity and basicity. Peptides: the peptide bond. Purine and pyrimidine bases. Nucleic acids.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	45,00	100
Seminars	10,00	100
Tutorials	2,00	100
Development of group work	10,00	0
Study and independent work	8,00	0
Preparation of evaluation activities	12,00	0
Preparing lectures	50,00	0
Preparation of practical classes and problem	10,00	0
TOTAL	**147,00**	

TEACHING METHODOLOGY

The development of the subject is structured concerning the following activities: the meetings of theory, classes of problems, the tutorships and coordinated seminars.

In **meetings of theory**, an overview of the topic will be given to the students, focusing on those most interesting key concepts for a better understanding. The most recommended resources for further preparation of each issue will also be included.

Concerning **tutorials**, they are one-hour sessions supervised by the teacher, with a small number of students (20 max.) mainly devoted to work on problems, with a total of 2 sessions. Teacher will guide the students on all elements of the learning process, both in terms of global approaches as to specific issues.

The **seminar no coordinated** sessions will be basically addressed to the resolution of problems and will be developed following two different strategies. In some sessions the teacher will explain a number of selected problems through which students can learn to identify the essential elements of the approach and the resolution of the problems of this topic. Teacher will be the most active agent in this case. In other sessions, by contrast, the role will entirely fall in the student, who will have to face similar and more complex problems and will expose them to other students.

There will be two **coordinated seminars** sessions addressed to oral presentation of works carried out by teams (3-4 students) that are coordinated with the other subjects of the first semester

- Every student in a team (3-4 students) must prepare a seminar for semester and course (not all the students will expose works in all
the subjects). The participation in this kind of seminars is compulsory to pass Organic Chemistry.

- The coordinator of the first year facilitates the subject for the coordinated seminar to every student, and any incident must be communicated to him.

- Teachers will guide students in the preparation of their reports and oral presentation of the corresponding topics.

- Students involved in several courses in an academic year will prepare a number of coordinated seminars proportional to the number of matters enrolled. In September, these students must contact the coordinators of these different courses.

- Erasmus students must contact with the degree coordinator in the first fifteen days after joining the University of Valencia because he will assign them the corresponding seminars.

- The order of presentation of the different components of each team will be communicated 24 hours before the oral presentation’s time.

Instructions to elaborate the report and to prepare the oral communication, and also some aspects of the evaluation of these seminars , will be accessible for students in “aula virtual”.

EVALUATION

Assessment of student learning will take place in three different sections:

1. A written examination (80% of the mark) to ensure the level of knowledge and understanding of the theoretical content and the ability to solve related questions. It is necessary to get at least 4 points (out of 10) in this block in order to be able to sum the other marks
2. Participation in lectures, tutorials and classes of problems (10% of the mark). It is compulsory the attendance at tutorials on the first registration in this subject.
3. Coordinated Seminars: Preparation, presentation and discussion of a topic related to the contents explained in class. The level of contents understanding and skills for presentation and discussion will be assessed. The contribution to the final mark of this activity will be 10%.

The mark obtained by the student in a coordinated seminar will be assumed, in the same semester, by the teachers of the other subjects.

The participation in a coordinated seminar is mandatory to pass the course. The evaluation criteria for coordinated seminars are unique for all the subjects and will be shown to the student in advance. The evaluation will be made on the basis of report, presentation in the established time and defense (see virtual classroom). The mark obtained in a coordinated seminar in a semester is valid during the same academic year and later. All students must attend the oral presentations of the other students or adequately justify the reasons for not attending.

- If the student has a mark in tutorials and/or coordinated seminars sections but doesn't make the first programmed theory exam, the final mark will be "not present", but in the second and following opportunities the student's mark will be "failed".

Evidence of copying or plagiarism in any of the assessable tasks will result in failure to pass the subject and in appropriate disciplinary action being taken. Please note that, in accordance with article 13. d) of the Statute of the University Student (RD 1791/2010, of 30 December), it is the duty of students to refrain from using or participating in dishonest means in assessment tests, assignments or university official documents.

In the event of fraudulent practices, the "**Action Protocol for fraudulent practices at the University of Valencia**" will be applied (ACGUV 123/2020):

https://www.uv.es/sgeneral/Protocols/C83sp.pdf

REFERENCES

Basic

- P. Yurkanis Bruice. Fundamentos de Química Orgánica. Ediciones Pearson Prentice Hall (2007)
- Karen C. Timberlake: Química. Una introducción a la química general, orgánica y biológica. Ediciones Pearson Prentice Hall, 2011

- 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

- K.P.C. Vollhardt. Química Orgánica Ediciones Omega, S.A. 5ªEd. (2007)
- L. G. Wade., Jr. Química Orgánica.Pearson Prentice Hall (2007)
- H. Hart, L.C. Craine, D.J. Hart, C.M. Hadad Química Orgánica McGraw-Hill (2007)