



UCAM
UNIVERSIDAD
CATÓLICA DE MURCIA

Course Guide 2019/2020

Organic Chemistry II

Bachelor's Degree in Pharmacy

Mode: On Campus

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Organic Chemistry II

Module: **Chemistry**

Subject.: **Organic Chemistry II**

Level: **Mandatory**

Nº of credits: **6 ECTS**

Academic Sessions: **1st year – 2nd semester**

Professors: **Dr. José Pedro Cerón Carrasco, Dr. José Antonio Gabaldón Hernández, Dr. Maria Encarnación Martínez Moreno**

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Availability: **Mondays from 15:15 to 17:15h; Wednesdays from 9:30 to 11:30h**

Professor head of the module: **Dr. Alfonso Pérez Garrido**

Brief Description

Students attending to this course will increase their knowledge on organic chemistry touched up on the Organic Chemistry I during the first semester. These basic skills enable students to homogenize their level of knowledge within the framework of other specific subjects of that degree in pharmacy. This subject must be consequently seen as a second part of the concepts shown during the first semester. In Organic Chemistry II, we will see now the reactivity of the main functional groups.

A professional degree in pharmacy must be in possession of a wide knowledge of structure and reactivity of organic compounds, a background that is essential for a proper understanding of the biochemical processes, metabolism and toxicology of drugs and their mechanism of action molecular level. Furthermore, this knowledge is also necessary to raise the preparation of compounds that preserve all their beneficial properties while mitigating undesirable side effects.

Prerequisites

There are not any specific prerequisites. However, it is highly recommendable to be familiar with properties, reactions and nomenclature of alkanes, alkenes and alkynes shown in Organic Chemistry I course.

Main goals

1. To know the characteristic of the main functional groups in organic chemistry.

2. To acquire a basic knowledge of their synthesis, including reacting mechanism and possible intermediates
3. To understand the main steps involved in their purification, which is indeed crucial in the pharmaceutical industry.
4. To become familiar with the procedures to isolate, characterize and identify the main basic organic compounds.
5. To go further in developing the ability of use experimental techniques available in to perform structural determination.

Competences and skills

Basic competences

(MECES1).- That students demonstrate to 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 its field of study.

(MECES2).- That students know how to apply their knowledge to their work in a professional way and have the skills that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

(MECES3).- That students have the ability to gather and interpret relevant data in order to make judgments that include a reflection on relevant social, scientific or ethical issues.

(MECES4).- That students transmit information, ideas, problems and solutions to a specialized and non-specialized public

(MECES5).- That students develop those learning skills necessary to undertake further studies with a high degree of autonomy.

General competences

(CG1).- To identify, design, obtain, analyze, control and produce drugs and medicines, as well as other products and raw materials of sanitary interest for human or veterinary use.

Organic Chemistry I

(CG10).- To design, apply and evaluate reagents, methods and clinical analytical techniques, knowing the basic fundamentals of clinical analysis and the characteristics and contents of laboratory diagnosis reports

(CG15).- To recognize limitations and the need to maintain and update professional competence, paying special attention to the self-learning of new knowledge based on scientific evidence.

Interdisciplinary competences

(CT5).- To acquire awareness of the risks and environmental problems associated with their professional practice.

(CT7).- Reading and listening comprehension, oral and written production that allows him to develop in a professional context in English. Interpretation of texts in technical and scientific English in the field of research. Communicate in Spanish and English using the usual audiovisual media

(CT8).- To defend personal points of view based on scientific knowledge

(CT9).- To integrate knowledge and apply it to resolve problems by using the scientific method

(CT11).- To development of autonomous or team work ability in response to the specific needs of each situation.

(CT13).- To progress in the ability of collaborating within multidisciplinary groups.

(CT14).- To pursue quality objectives in the development of their professional activity.

(CT15).- To acquire capacity for decision making and management of human resources .

(CT16).- To be able to show creativity, initiative and entrepreneurial spirit to face the challenges of his activity as a pharmacist.

Specific competences

(CEM1.4). To estimate the risks associated with the use of chemical compounds and laboratory processes.

(CEM1.8). To know and to understand the nature and the properties of the main functional groups present in organic molecules

(CEM1.22). To learn how to name and represent organic compounds upon chemical modifications.

Methodology

Methodology	Hours	Classroom work	Homework
Classroom sessions	18	60 (40 %)	
Academic tutorials	6		
Laboratory sessions	18		
Seminars	12		
Classroom evaluations	6		
Personal study	63		90 (60%)
Tutorials	9		
Resolution of exercise and practical	9		
Project completion and oral presentations	9		
TOTAL	150	60	90

Class Outline

Theoretical program

1. halogen derivatives of alkanes: F and Cl as a working examples in pharma industries.
2. Aromatic rings: characteristics, properties and spectroscopy signatures. Aromatic substitution reactions. Polyaromatic molecules.
3. Hydroxyl group: alcohols. Natural and synthetic sources, main reactivity, transposition phenomena. Related compounds: ethers, phenols, and S-derivatives.
4. Amines: Structure, synthesis and properties. Diazonium salts and Hoffman elimination.
5. Aldehydes and ketones: synthetic steps, properties and experimental techniques for their characterization. Addition/elimination reactions, Witting route. Oxidation/reduction processes.

Keto/enolic tautomerization. Other main reactions, including reactivity with halogens and aldol condensation.

6. Carboxylic acids: Synthesis and properties. Protonation/deprotonation reactions: acid/basic equilibria. Reduction, halogenation and decarboxylation.
7. Carboxylic acid derivatives: properties and reactivity, including Claisen, malonic acid but all carboxylic routes.
8. Heterocycles: Definition and main classification. Aromaticity along with heterocycles of five and six members. Larger heterocycles with more than one heteroatom. Main heterocycles in

Lab sessions

1. Synthesis of the aspirin.
2. Cannizzaro reaction.
3. Synthesis of carboxylic derivatives: ethyl acetate.
4. Practical identification of functional groups in the laboratory.
5. Reaction with benzene: Friedel-Crafts.
6. Exam

Links to other subjects

This subject is directed related to Organic Chemistry I, so that it is largely recommended to correctly acquire the main skills of that subject of the first semester prior to start with Organic Chemistry II. In addition, Organic Chemistry II is closely related with Introduction to work in the laboratory, Pharmaceutical Chemistry I and II, Physico-chemistry, Inorganic Chemistry, General Chemistry and Analytical Techniques.

Grading system: June/September

- **Theoretical tests**, which accounts for the 60% in the final mark. The exams will include short questions and/or problems, including a specific test for assessing the acquired knowledge in organic chemistry formulation. The cut-off note for this part is 5.0.
- **Practical tests and seminars**, which accounts for the 40% in the final mark. All students must pass specific tests for the more practical part of that subject. Students must be able to perform

experiments in the laboratory as well as to resolve practical exercise, e.g., numeric problems related to everyday organic chemistry problems. The cut-off note for this part is 5.0.

Please, notice that if the student has less than 5.0 in any of the parts the subject will be suspended, and the student must retake the part(s) in the next session within the same academic year. The suspended part(s) in official sessions (February/June) will be saved for successive sessions that are held in the same academic year.

It must be finally stressed that if the subject is not passed in the September session, the passed parts will not count for successive academic years.

The grading system (RD 1.125/2003. of September 5) shall be the following:

- 0-4.9 Suspended
- 5.0-6.9 Passed
- 7.0-8.9 Excellent
- 9.0-10 Outstanding (SB)

Honorable mention may be granted to students who have earned a grade equal to or greater than 9.0. This number may not exceed 5% of the total number of students enrolled in a subject in the corresponding academic year, unless the number of students enrolled is less than 20, in which case only a single honorable mention may be granted.

Bibliography

- McMurray, J. Organic Chemistry. **Publisher:** Cengage Learning.

Short description

The most trusted and best-selling text for organic chemistry just got better! Updated with the latest developments, expanded with more end-of-chapter problems, and reorganized to cover stereochemistry earlier, the leading online homework and learning system for chemistry, John McMurry's *Organic Chemistry* continues to set the standard for the course. The eighth edition also retains McMurry's hallmark qualities: comprehensive, authoritative, and clear. McMurry has developed a reputation for crafting precise and accessible texts that speak to the needs of instructors and students. More than a million students worldwide from a full range of

universities have mastered organic chemistry through his trademark style, while instructors at hundreds of colleges and universities have praised his approach time and time again.

- Morrison, R.T.; Boyd, R.N. Organic Chemistry. **Publisher:** Pearson

Short description

In this classic introductory text, the authors aim to identify the new concepts of organic chemistry, to select the ones that are clearly fundamental to the learning of organic chemistry, and then to build them into a framework of the book. The cornerstone of this framework is that chemical behavior is determined by molecular structure. Each topic is presented fully and clearly at a level appropriate for beginning students. The authors emphasize relationships between the seemingly unrelated facts and theories that students are learning in order to reveal the broad and complex pattern underlying organic chemistry. Where possible, they lead the students to find the pattern themselves, by working problems.

- Vollhardt, C.; Schore, N.E. Organic Chemistry. **Publisher:** W. H. Freeman

Short description

An introductory text, providing early coverage of acids and bases, improved presentation of reaction mechanisms, and innovative approaches to problem solving. Color computer-generated diagrams emphasize building molecular models as an aid to visualizing structure. Includes chapter integration problems, team problems, and preprofessional problems similar to the MCAT, GRE, and DAT. Some editions include multimedia material.

Additional references

It is crucial to be confident in organic chemistry nomenclature, which will be specifically evaluated during our course. Consequently, students are advocated to learn about key rules for correctly identifying and formulating organic compounds. There are many available text books, we here include one of them:

- Traynham, J. Organic Nomenclature: A Programmed Introduction. **Publisher:** Prentice Hall

Short description

The book provides a quick guide/review of organic chemical nomenclature rules. Organic Nomenclature: A Programmed Introduction provides correct, up-to-date nomenclature usage. It emphasizes the rules, styles, and details of IUPAC names -- such as punctuation and spacing -- which are used almost exclusively in Chemical Abstracts indexing. The book includes a separate treatment of functional group classes and combines coverage of aliphatic and aromatic compounds. It focuses more on systematic nomenclature than on unsystematic names that may have little use in the future. The fifth edition of Organic Nomenclature: A Programmed Introduction has been updated to incorporate recently revised IUPAC recommendations on organic chemical nomenclature. In addition, the information included in Chapter 15 of previous editions is now incorporated throughout this fifth edition. A valuable reference book for professional chemists seeking an up-to-date guide to correct nomenclature usage.

Study recommendations and academic honesty

Students are advocated to assist to all lectures and to follow, step by step, all material distributed by the professors. It is also expected that students will keep the highest standards of academic honesty. Departures from the UCAM's standard during homework assignments and/or examinations will be no permitted.

Teaching materials

- Online material available at the Virtual Campus, including references to works published in international journals, videos with animation of the main reactions, and news in the field of drug design based on organic compounds.
- Software for modeling and visualizing organic compound
- Molecular models based on balls and sticks to further understand the main principle of stereochemistry and reactivity.
- All used slides will be available at the Virtual Campus as pdf files
- All proposed exercise will be deposited in both Virtual Campus and in the reprographics center available on the university.

Tutorials

The academic tutoring will have among its objectives to guide students on the contents of the subject, study methods and evaluation system. The doubts about the taught subject will be solved and basic

concepts will be reinforced for an adequate follow-up of the syllabus, in those students that require it. In addition, it will be advisable to read different articles and monographs to expand the knowledge of the subject. The University also has a Special Body of Tutors that conducts personal tutoring with the students enrolled in the degree. The personal tutor accompanies the students throughout the university stage. Further information at <https://www.ucam.edu/servicios/tutorias>