

**COURSE DATA****Data Subject**

Code	34206
Name	Organic chemistry laboratory I
Cycle	Grade
ECTS Credits	6.0
Academic year	2012 - 2013

Study (s)

Degree	Center	Acad. year	Period
1108 - Degree in Chemistry	Faculty of Chemistry	2	Second term

Subject-matter

Degree	Subject-matter	Character
1108 - Degree in Chemistry	9 - Organic chemistry	Obligatory

Coordination

Name	Department
DOMINGO ASENSI, LUIS RAMON	325 - Organic Chemistry
PARRA ALVAREZ, MARGARITA	325 - Organic Chemistry
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SUMMARY

Organic chemistry deals with the study of the structure and reactivity of compounds of carbon, usually known as organic molecules. It is easy to understand the importance of organic compounds if we consider that among them are the vast majority of compounds essential to life as lipids, sugars, proteins or nucleic acids. In addition to these substances, which are involved in the primary metabolism of living beings, there are other organic compounds that possess pharmacological activity and are the basis of drugs. In addition, there are these substances, pesticides, fertilizers, herbicides, preservatives, dyes, scents, perfumes, plastics, rubbers, varnishes, paints, coatings, adhesives, textile fibers, fuels and many other types of materials essential for modern life and are also organic molecules.

The continuous advancement of discipline within a sustainable framework to the environment, is enabling the development of new compounds and organic materials that keep-improving the quality of life we enjoy today, present less risk to health or have a lower environmental impact than other previously designed compounds.



The number of new organic substances that are described every year is very high and if we want to understand the very different properties, applications, and potential problems in the use of organic compounds, the knowledge of the factors that determine its structure and its reactivity is essential. That kind of knowledge is determined in a manner in this sense, Organic Chemistry I Laboratory and experimental is a compulsory subject of 4th semester of the degree in chemistry which allows the student to acquire skills in laboratory work, in general, and in particular, seat and deepen the knowledge of the basics of working in the laboratory of organic chemistry and the manipulation of organic compounds. For the realization of this laboratory is based on the know-how acquired in the laboratories of Chemistry I and II (first course) (see section VIII: prior knowledge) and the subjects of theoretical Organic Chemistry I (3rd semester) and Organic Chemistry II (4th semester, simultaneously with the laboratory).

The objectives to be achieved in this subject can be summarized in the following points:

- that the student learn and observe the safety rules and operate with fluent material, apparatus and reagents used in a laboratory of Organic Chemistry.
- that the student learn and follow the various methods of waste treatment
- that the student learn the bibliographical sources unfolding fluently in the search for information by selecting it and collecting and properly.
- that the student learn how to prepare, develop, and properly record an experimental work in Organic Chemistry and to analyze the results obtained.
- the student learn both the basis and the possibilities of the standard techniques in Organic Chemistry.
- that the student know about and perform the characterization and identification of organic compounds.
- that the student carry out getting different organic compounds, either by a direct transformation (a stage) or by a synthetic sequence (synthesis by stages).
- that the student develop the critical spirit necessary in any scientific activity.
- that the student acquire the experience necessary to correctly interpret any experimental procedure as well as prepare and develop an experimental procedure simple face and solving the problems that may arise, analyzing the results obtained and conclusions are drawn.
- that the student know express themselves properly both orally and in writing
- enhance the skills of the student to work in a team.
- that the student will be able to relate the acquired knowledge to everyday life.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

The work to be performed at the Laboratory of Chemistry I is based on the knowledge developed in the courses General Chemistry I and II, Organic Chemistry I and Organic Chemistry II (the latter given simultaneously with the laboratory).

From a practical point relies on the knowledge must be acquired in the laboratories of Chemistry I and II. For more details see Guide Department.



OUTCOMES

1108 - Degree in Chemistry

- Develop capacity for analysis, synthesis and critical thinking.
- Show inductive and deductive reasoning ability.
- Demonstrate leadership and management skills, entrepreneurship, initiative, creativity, organization, planning, control, leadership, decision making and negotiation.
- Solve problems effectively.
- Toma de decisiones.
- Demonstrate ability to work in teams both in interdisciplinary teams and in an international context.
- Comunicación oral y escrita en las lenguas nativas.
- Trabajo en un equipo de carácter interdisciplinar y/o en un contexto internacional.
- Razonamiento crítico.
- Capacidad de gestión de la información.
- Demonstrate a commitment to ethics, equality values and social responsibility as a citizen and as a professional.
- Learn autonomously.
- Demonstrate the ability to adapt to new situations.
- Creatividad.
- Liderazgo.
- Motivación por la calidad.
- Acquire a permanent sensitivity to quality, the environment, sustainable development and the prevention of occupational hazards.
- Demonstrate knowledge of the main aspects of chemical terminology, nomenclature, conventions and units.
- Interpret the variation of the characteristic properties of chemical elements according to the periodic table.
- Demonstrate knowledge of the main types of chemical reaction and their main characteristics.
- Demonstrate knowledge of the principles of thermodynamics and kinetics and their applications in chemistry.
- Ability to recognise chemical elements and their compounds: preparation, structure, reactivity, properties and applications.
- Demonstrate knowledge of the principles, procedures and techniques for the determination, separation, identification and characterisation of chemical compounds.



- Demonstrate knowledge and understanding of essential facts, concepts, principles and theories related to the areas of chemistry.
- Solve qualitative and quantitative problems following previously developed models.
- Recognise and analyse new problems and plan strategies to solve them.
- Evaluate, interpret and synthesise chemical data and information.
- Handle chemicals safely.
- Carry out standard experimental procedures involved in synthetic and analytical work, in relation to organic and inorganic systems.
- Handle the instrumentation used in the different areas of chemistry.
- Interpret data from observations and measurements in the laboratory in terms of their significance and the theories that underpin them.
- Evaluate the risks in the use of chemicals and laboratory procedures.
- Relate theory and experimentation.
- Recognise and evaluate chemical processes in daily life.
- Understand the qualitative and quantitative aspects of chemical problems.
- Develop sustainable and environmentally friendly methods.
- Relate chemistry with other disciplines.

LEARNING OUTCOMES

In this subject there will be approached the following results of learning contained in the document of Degree, inside the Chemical Organic matter:

- 1.- To demonstrate knowledge of the principal aspects of terminology and organic nomenclature. (CE1)**
- 2.- To understand the structural properties and the reactivity of the compounds and of the functional organic groups applying them to the solution of synthetic and structural problems. (C16, C21, CE2, CE4, CE6, CE7, CE23, CE26)**
- 3.- To elucidate the structure of the organic simple compounds, using spectroscopic technologies. (CE8, CE19)**
- 4.- To explain in an understandable way phenomena and processes related to the Organic Chemistry. (C1, C2, C12, CE13)**
- 5.- To acquire and to use bibliographical information and technology referred to the organic compounds. (C13, CE16)**
- 6.- To write and to exhibit in the native language with correction (C8)**



- 7.- To realize effectively the tasks assigned as member of an equipment with perspective of kind (C7, C9, C18, C19)
- 8.- To demonstrate knowledge of sustainable methodologies in organic chemistry. (CE25)
- 9.- To demonstrate skill to manipulate chemical reagents and organic compounds safely. (CE17)
- 10.- Aptitude to plan and carry out experimentally simple syntheses of organic compounds safely and using the suitable technologies. (C3, CE18, CE21)
- 11.- Aptitude to elaborate a memory of a laborator practice. (C8, CE16)
- 12.- Interpretation of information proceeding from observations and measures in the laboratory in terms of his significance and of the theories that sustain it. (CE20, CE22, CE24)
- 13.- To take decisions with rigor. (C6, C15, C17)
- 14.- To demonstrate critical reasoning. (C12)
- 15.- To demonstrate autonomous learning. (C16)
- 16.- To solve problems with rigor. (C5, C20, CE14, CE15)

These results of learning have to allow that on having finished the subject the student has to be capable of acquiring the following skills:

To acquire skills

- o Know and apply the safety rules regarding the handling of chemicals, equipment and apparatus used in an organic chemistry laboratory to minimize risks.
- o Know and apply the waste in a laboratory of Organic Chemistry.
- or Knowing how to find, interpret and synthesize relevant information about the physical, chemical and chemical safety.
- or Knowing how to find, interpret and synthesize the most relevant information for each experience and apply it appropriately in each context.
- o Recognise and know how to use the material and / or equipment most appropriate in each situation.
- o Prepare an experience to perform the laboratory analysis and application of experimental procedures.
- o Know and properly use the most common separation methods at the Laboratory of Organic Chemistry: liquid-liquid extraction, filtration (vacuum, gravity, pleated filter), distillation (simple distillation, vacuum distillation, distillation in a rotary evaporator) .
- o Know and properly use the most common purification methods in the Laboratory of Organic Chemistry: crystallization of solids (water, organic solvent, solvent mixture), distillation of liquids.
- or learn to appreciate the purity of a solid or liquid compound by its mp, bp CCF.
- o Know the basis of the technique of thin layer chromatography and apply it correctly in the analysis and comparison of compounds with the choice of eluents, methods of analysis and visualization of results.
- o Use the correct technique of thin layer chromatography in following the evolution of a reaction.
- o Perform basic setup properly than to carry out reactions and / or operate at both low and high temperature, with special emphasis on safety precautions.
- or Apply the processes of separation, purification and characterization of compounds of a reaction mixture.
- o Develop the ability to observe and record correctly noting observable changes when performing experience (state changes, color changes, heat release etc)..



Calculate and interpret or income: gross yield, yield pure product, performance stages.

o Understand what a change of scale and be able to modify quantities of a process without affecting its development.

or acquire the necessary experience to properly prepare the experimental work in the laboratory of Organic Chemistry from the analysis procedure development.

or get enough experience to be able to propose and develop a simple experimental procedure.

o Develop the ability to solve problems facing a practical problem and attempt to fix it.

or Relate knowledge to daily life.

o Reaching an optimal degree of experimentation to correctly interpret any experimental procedure.

o Know the basic language of the Laboratory of Organic Chemistry in English.

Social Skills

Ability to deal appropriately with a laboratory of Organic Chemistry

Ability to meet the challenges of the experimental work.

Ability to make decisions individually.

Ability to work as a team.

Ability to solve problems through the integrated application of knowledge.

Ability to express orally in a precise and clear.

Ability to express in writing an organized and concise.

DESCRIPTION OF CONTENTS

1. Seminar

INTRODUCTION. Objectives. Space. Security. Material. Compounds. Basic language. Waste. Preparation of experimental work: Finding, interpreting and organizing information.

2. SEPARATION, PURIFICATION, CHARACTERIZATION AND IDENTIFICATION OF THE COMPONENTS OF TERNARY MIXTURES

SEPARATION, PURIFICATION, CHARACTERIZATION AND IDENTIFICATION OF THE COMPONENTS OF A ternary mixture (Acid + Base + Neutral): Application of basic laboratory techniques: liquid-liquid extraction, filtration, crystallization, melting, simple distillation, distillation in Rotavapor, CCF.

3. Nucleophilic substitution reaction

Nucleophilic substitution reaction: Synthesis of a liquid alkyl halide (eg. Synthesis of tert-butyl chloride).

4. Oxidation reactions

Oxidation reaction: Oxidation of an alcohol (eg. Oxidation of cyclohexanol to cyclohexanone).

**5. Reduction reaction**

Reduction reaction: Reduction of a carbonyl compound. Monitoring the progress of a reaction by TLC (eg. Reduction of benzophenone to difenilmetanol)

6. Fischer Esterification Reaction

Fischer Esterification Reaction: Synthesis of a liquid ester. Vacuum distillation (eg. Benzoate)

7. Aldol condensation reaction

Aldol condensation reaction: Synthesis of a ketone α,β -unsaturated (eg DIBENZALACETONE Synthesis)

8. Synthetic sequence

Synthetic sequence: From a p-nitroaniline acetanilide: a) Nitration of acetanilina. b) Hydrolysis of the p-nitroaniline.

WORKLOAD

ACTIVITY	Hours	% To be attended
Laboratory practices	48,00	100
Theory classes	12,00	100
Study and independent work	90,00	0
TOTAL	150,00	

TEACHING METHODOLOGY

Before the first experimental session will be held an introductory seminar. ASSISTANCE REQUIRED FOR THIS SEMINAR WILL BE ABLE TO MAKE THE PRACTICE.

This seminar will cover the following topics:

- The Laboratory of Organic Chemistry and Applied Organic Chemistry: Objectives and limitations of the experimental work in organic chemistry.
- Laboratory Safety: Safety and compliance; Use blankets, fire extinguishers and so on. Use of Showcases, Exits and emergency protocol.
- Organization of laboratory work: Standards and timing.



- Material and equipment: material per job, common, in addition, use of catalogs, English names, handling and safety (broken material, use a vacuum and so on.) Cleaning and drying, scale of work.

- reagents and products: Labeling commercial physical, chemical, origin, uses and safety Proper handling of solids and liquids. Specimen labeling, storage and destruction of waste.

- lab notebook and / or laboratory notebook:

A) Preparation of experimental work and data collection, search and sort the information according to the following scheme.

1) Introduction and Objectives.

2) Experimental Procedure

3) Notes to the experimental procedure:

3.1. Techniques to use

3.2. Material Required. Drying

3.3. List of reagents, solvents and products, including intermediates or secondary.

For each compound should have a sheet that includes: semidesarrollada formula, name, physical and chemical properties, hazards, toxicity, storage or destruction, origin, usage). Since in many cases a different compound is used in practice these sheets may be included in Annex within the notebook.

3.4. Relationship between substrate / s, reactive / s and solvent used in the experimental procedure: substrate molar ratio / s reagent / s.

3.5. Special security precautions.

3.6. Additional notes with its reference to the experimental procedure: important points to consider in the experimental procedure, final changes, and so on.

4) separation scheme (flow chart semidesarrolladas formulas which indicate the likely composition of each phase after each operation to the final product)

5) Experimental observations.

6) Results: composite / s, name, formula semidesarrollada, amount realized, performance and features of the product / s obtained.

7) Comments and conclusions.

B) The approach of the experience and record of experimental work. Follow the following scheme



A) Approach of the experience:

- 1) Title of the experience
- 2) Objective / s
- 3) chemical equations (if required)
- 4) List of material
- 5) Table / s summary of physical data (only useful for the experience) and safety of all reactants and products including intermediates or secondary.
- 6) Table summarizing the amounts of reagents (Composite or dissolution, volume, density, weight, PM. Mol or mmol)
- 7) Work plan: a schematic overview of the experimental procedure to perform.

B) Record of the experience: It should be noted clear

Weighed quantities / measures.

Personal observations on the work as is being done.

Drawings of assemblies or devices with appropriate entries.

Calculations.

Results.

Suggestions for improving the results of experimental work

Experiences that are not completed in the session to raise and organize work to the next session.

- Delivery of outputs and outcomes.
- The experimental work in progress: As time efficiently leverage; When can stop?; Where's the product? Security: What to do if?

The development of the course is structured around different axes:

a) Teaching materials: the students will have all the educational material for the course in the Virtual Classroom.



b) Preparation of experience to perform: PREPARATION PREVIOUS EXPERIMENTAL WORK IS REQUIRED TO ACCESS THE LABORATORY. After defining the objectives the student must carry out the preparation of each of the experiences compiling relevant information from the sources indicated by the teacher and ordering them appropriately. The teacher can review the material prepared and limit access to the laboratory if it is not appropriate.

Of special note in this section:

1. Knowledge of the characteristics and safety of compounds and techniques involved.
2. Preparation and analysis of the separation scheme that allows greater understanding of the experience and the factors that contribute to a good result. This analysis allows the student to understand what it does and why and correct or adjust the procedure in case of error or if the expected results do not coincide with expectations.

Optionally you may want to prepare a scheme of work to be done in order to have a clear idea of the different operations carried out, order them and details to take special care to obtain good results.

c) Seminars: In addition to the Introductory Seminar before each session will be held a short seminar. These seminars will take place either by the teacher presentations or by students working in small groups. Devoted to:

1. Presentation and discussion of the experience to make and resolve doubts about the work carried out.
2. Analysis of the results obtained in previous sessions, identifying problems and how they were resolved or could be solved in order to develop the student's analytical skills, enhance information sharing and teamwork

d) Work in the laboratory. Depending on the number of students per group experiences are carried out individually or in pairs. In the latter case it is advisable to introduce some practical ways to accomplish individually.

In order to enhance the student's responsibility in the functioning of the laboratory and teamwork small weekly tasks were allocated for students to contribute to a smooth operation.

The experiences are designed so that in general can be performed during a laboratory, although the drying of solid compounds to calculate yield and characterization should be performed in a later session.

The core of the laboratory work is the immediate registration of the same in the notebook. The teacher can check the newspaper to check this point.



EVALUATION

The evaluation of learning takes place continuously evaluating the following sections:

a) WORK AND LABORATORY RESULTS (40%). Taking into account the observation of safety rules, attitude, preparation, work in the laboratory and the results and analysis.

To do this you must consider the following general rules:

1. INTRODUCTORY SEMINAR ON ASSISTANCE IS REQUIRED TO BE ABLE TO MAKE PRACTICE.
2. You must know and respect the general rules and safety indicated.
3. Must necessarily be provided by: Bata, safety goggles, rubber gloves, spatula or spoon, pencil and calculator.
4. It must be in possession of the book / s with the experimental work properly trained. The notebooks will be reviewed by the teacher before the practice session and / or the notebook has to respond to some written questions.
5. Both at the beginning of the practice session as the end must perform general tasks assigned to count the material and the workplace.
6. The sessions do not recover. The non-performance of more than three practice sessions involve the loss of qualification for the laboratory work and results. The absences and punctuality must be properly justified and the justification will be evaluated by the teacher.

b) Seminar (10%) will be assessed the preparation, drafting and presentation of the work assigned, and the same compression and the ability to answer questions that are formulated either by the teacher or other students.

c) written exams (50%) may be of two types:

Examination Questions: consist of practical questions related to the experiences that have hitherto been directly related to them or to show both the global knowledge of the student as his writing ability. Them, try to evaluate the research, collecting and organizing information for the student and determine whether to master it. It also aims to establish the relationship with the available knowledge of the subject of Organic Chemistry I and II.

Practical Exams: carry out experimental work not scheduled in the appropriate level of difficulty of the subject.

In the evaluation of the second round, there will be kept the qualification obtained in the continued evaluation (point 1-" direct Evaluation of the Teacher and Point 2-" Seminars of Organic Chemistry and Tutorships ") of the first round and it(he,she) will proceed to evaluate again the part corresponding to the Point 3 - "Examinations"-



REFERENCES

Basic

- M^a A. Martínez Grau y A. G. Csáky. TÉCNICAS EXPERIMENTALES EN SÍNTESIS ORGÁNICA Ed. Síntesis, 1998.
- H.D. Durst y G.W. Gokel "QUÍMICA ORGÁNICA EXPERIMENTAL", Ed. Reverté (1985).
- B.S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell "VOGEL's TEXTBOOK OF PRACTICAL ORGANIC CHEMISTRY.", Ed. Longman (1989).
- L.M. Harwood y C.J. Moody "EXPERIMENTAL ORGANIC CHEMISTRY", Ed. Blackwell Sci. Publ. (1989).
- D.R. Palleros EXPERIMENTAL ORGANIC CHEMISTRY. John Wiley and Sons (2000)

Additional

- Características de los compuestos (datos físicos, químicos, seguridad etc.):
 - a) Inst. Nacional de Seguridad e Higiene en el Trabajo (Ministerio de Trabajo e Inmigración)
 - b) Catálogo SIGMA-ALDRICH (Casa Comercial)
 - c) CHEMnetBASE reúne una serie de Bases de datos como:
 1. Combined Chemical Dictionary (CCD)
 2. The Handbook of Chemistry & Physics
 - d) Index Merck (libro que se puede encontrar en la biblioteca)