Universitat de Lleida

DEGREE CURRICULUM

GENERAL AND ORGANIC CHEMISTRY

Coordination: VILLORBINA NOGUERA, GEMMA

Academic year 2022-23

GENERAL AND ORGANIC CHEMISTRY 2022-23

Subject's general information

<table>
<tr><td>Subject name</td><td>GENERAL AND ORGANIC CHEMISTRY</td></tr>
<tr><td>Code</td><td>101600</td></tr>
<tr><td>Semester</td><td>ANUAL CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
<table>
<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Biotechnology</td><td>1</td><td>COMMON/CORE</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>10.5</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
<table>
<tr><th>Activity type</th><th colspan="2">PRALAB</th><th colspan="2">PRAULA</th><th>TEORIA</th></tr>
<tr><th>Number of credits</th><td>1.2</td><td>0.4</td><td>2.8</td><td>0.2</td><td>5.9</td></tr>
<tr><th>Number of groups</th><td>6</td><td>9</td><td>1</td><td>2</td><td>1</td></tr>
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</td></tr>
<tr><td>Coordination</td><td>VILLORBINA NOGUERA, GEMMA</td></tr>
<tr><td>Department</td><td>CHEMISTRY</td></tr>
<tr><td>Teaching load distribution between lectures and independent student work</td><td>Contact hours Non-contact hours
Master lesson 47 80
Problem session 40 73,5
Laboratory 16
Computer classroom 2</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>Catalan (Organic Chemistry) / Spanish (General Chemistry)</td></tr>
<tr><td>Distribution of credits</td><td>129 hores de dedicació a teoria
115,5 hores de temps total per problemes
16 hores pràctiques de laboratori
2 hores pràctiques aula d'informàtica</td></tr>
</table>

GENERAL AND ORGANIC CHEMISTRY 2022-23

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
DAGO BUSQUETS, ANGELA	angela.dago@udl.cat	3	
GARCES GONZALEZ, JOSEP LLUIS	josepllluis.garces@udl.cat	2,4	
GIL MESTRES, ADRIA	adria.gil@udl.cat	1,2	
MORALEJO VIDAL, MARIA DE LOS ANGELES	marian.moralejo@udl.cat	1	
PINTO PAGES, ESTHER	ester.pinto@udl.cat	,6	
SALVADOR TUREGANO, JOSE	jose.salvador@udl.cat	6,1	
VILLORBINA NOGUERA, GEMMA	gemma.villorbina@udl.cat	5,6	

Subject's extra information

PERSONAL PROTECTIVE EQUIPMENT (PPE) for the practical sessions

It is **MANDATORY** that students have the following personal protective equipments (PPE) in the course of teaching practices.

- Laboratory coat UdL unisex
- Safety glasses
- Chemical protection gloves

The PPE can be purchased at UdL's ÚDELS store

Center for Cultures and Cross-Border Cooperation - Cappont Campus

Carrer de Jaume II, 67 low

25001 Lleida

http://www.publicacions.udl.cat/

For more information, check the product listings: http://www.biotecnologia.udl.cat/en/pla-formatiu/equipament.html

For other protection equipment (for example, caps, respiratory masks, etc.), they will depend on the type of practice to be performed. In this case, the responsible professor will inform if the use of these specific PPE is necessary.

Not carrying the PPE described or not complying with the general security regulations detailed below will mean that the student can not access the laboratories or have to leave the same.

GENERAL SAFETY RULES IN LABORATORY PRACTICES

- Maintain the place of performance of clean and tidy practices. The work table must be free of backpacks, folders, coats ...
- In the laboratory you can not come with shorts or short skirts.
- Bring closed and covered shoes during the performance of the practices.
- Bring long hair always collected
- Keep the cords fit to protect against spills and spills of chemical substances.
- Do not carry wide bracelets, pendants or sleeves that can be trapped by the equipment, assemblies ...
- Avoid wearing contact lenses, since the effect of chemicals is much greater if they are introduced between the contact lens and the cornea.
- Do not eat or drink in the laboratory
- Smoking is prohibited within laboratories
- Wash your hands whenever you have contact with a chemical and before leaving the laboratory.
- Follow the teacher's instructions and consult any questions about security

Learning objectives

The basic training of future Biotechnologists necessarily includes the understanding of the chemical concepts and the acquisition of abilities for its application to the practical cases that will be found in their professional future and in other subjects of degree's syllabus. It is precisely the basic training -which makes it possible to construct an essential conceptual framework that is indispensable- that distinguishes a university degree from a person who has undergone practical studies of applied guidance (training cycles).

Competences

General Skills:

- GC 1 Being able to selectively search for and use sources of information necessary to achieve the training objectives.
- GC 4 Knowing and adequately using the scientific and technical vocabulary of the different areas of Biotechnology.
- GC 5 Working in the laboratory applying criteria of quality and good practice.
- GC 7 Using the scientific method to analyze data and design experimental strategies with biotechnological applications.
- GC 9 Being able to carry out a professional activity in accordance with safety regulations and respect for the environment and with ethical criteria.
- GC 11 Acquiring criteria for choosing the most appropriate analytical techniques for each specific practical case.

Specific competences:

- CE 1 To know and understand the fundamentals of general, analytical and organic chemistry.
- CE2 To know and understand the chemical fundamentals of biotechnological processes.
- CE3 To know how to handle the essential instruments of a chemical laboratory.
- CE4 To know the principles of physical chemistry and being able to solve problems related to the kinetics of chemical reactions.

GENERAL AND ORGANIC CHEMISTRY 2022-23

Subject contents

THEORETICAL CONTENTS:

I. INTRODUCTION TO CHEMISTRY.

1. Role of chemistry to contemporary society
2. Material states
3. Mol concept
4. Solutions. Concentration expression
5. Stoichiometry and chemical reactions
6. Chemical reactions types (acid/base, precipitation and redox)
7. The gas laws

II. ATOMIC AND MOLECULAR STRUCTURE.

1. Atomic structure. Periodic system
2. Chemical bond. Lewis structures
3. Valence shell electron pair repulsion theory (VSEPR)
4. Intermolecular forces

III. CHEMICAL EQUILIBRIUM.

1. Introduction to thermodynamics
2. First law
3. Thermodynamics
4. Standard enthalpy of reaction. Gibbs law
5. Spontaneity and second law
6. Gibbs energy
7. Spontaneity conditions and equilibrium
8. Ideal gas constant
9. Displacement of chemical equilibrium. Le Chatelier's principle
10. Chemical equilibrium in heterogeneous systems

IV. ACID-BASE EQUILIBRIUM.

1. Arrhenius concept
2. Brönsted-Lowry acid-base concept
3. Water autoionization and pH scale
4. Hydrolysis
5. Acid-base equilibrium approach
6. Buffer solutions
7. pH measurement. Indicators
8. Acid-base titration
9. Polyprotic acids
10. Lewis acid-base concept

V. PRECIPITATION AND COMPLEXATION EQUILIBRIUMS.

1. Solubility and precipitation
2. Complexation

VI. ORGANIC CHEMISTRY NOMENCLATURE

1. Organic functional groups
2. Hydrocarbons nomenclature: saturated, unsaturated, lineal, branched and cyclic. Alkyl radicals
3. Nomenclature of substituted compounds: substitutive, radicofunctional. Trivial names of some compounds
4. Aromatic compounds nomenclature

VII. ISOMERISM

1. Isomer classification
2. Conformational isomer

2.1 Lineal alkane conformational isomers

2.2 Cyclic alkane conformational isomers

1. Configurational isomers

3.1 Optical rotation. Optical active molecules

3.2 Chirality.

3.3 Enantiomers. Absolut configuration. Racemic mixtures

3.4 Fisher projection. Absolut configuration in a Fisher projection. *D*- and *L*- notation

1. Molecules with more than one stereocenter. *Meso* compounds
2. Resolution of enantiomers
3. *Z*- and *E*- notation

VIII. STRUCTURE-PROPERTY RELATIONSHIP

1. Hydrocarbon: chemical structure and chemical and physical properties
2. Halogenated compounds: structure, polarity and properties
3. Alcohols: structure, polarity, properties and hydrogen bond
4. Carbonyl compounds. Bond polarity and properties
5. Carboxylic acids and derivatives: intermolecular interactions and properties
6. Amines: structure, polarity and properties
7. Aromatic compounds: symmetry and properties

IX. REACTIVITY

1. Terminology and basic concepts of Organic chemistry reactivity: reaction types, electrophiles and nucleophiles,…
2. Oxidation and reduction reactions with different functional groups
3. Nucleophilic substitution reactions
4. Elimination reactions. Zaitsev rule
5. C-C bond addition reactions. Markovnikov rule
6. C=O bond addition reactions. Hemiacetals and acetals
7. Alpha carbon addition
8. Electrophilic substitution reactions

PRACTICE ACTIVITIES:

Laboratory session 1. Preparing standard solutions and titration. Determination of Acetic Acid in vinegar and redox titration

Laboratory session 2. Separation of a mixture of organic compounds

Laboratory session 3. Production of flavours by Fischer esterification

Computer session. Use of the GINY and EQUIL software

Methodology

- Master classes, alternating face-to-face and non face-to-face sessions
- Problems and questions discussion with small groups.
- Laboratory sessions with the aim of knowing the laboratory safety procedures and the techniques useful for the subject.
- Computer session with simulation of chemical equilibrium and molecular geometry.
- Alternative activities will be carried out for all those activities that cannot be carried out normally due to the current situation

Development plan

The two parts, “General Chemistry” and “Organic Chemistry” will be developed in parallel. In the theory part problems and questions will be recommended, that will be discussed in the small group sessions.

Evaluation

The final qualification comes from three global sources: theory and problems of General Chemistry part (45%); theory and problems of Organic Chemistry part (45%); and practices (10%). To pass the subject, a minimum score of 5 out of 10 is required in each sources.

General Chemistry part:

In the *General Chemistry* part, between 30 and 50% of the mark will come from a test type or a test consisting of questions or short answer exercise resolution and the other 70-50% will come from problems resolution. The subjects of the successive exams are cumulative.

The mark of *General Chemistry* first call comes from the mark of the first partial exam (p1) in November and the second partial exam in January (jan) as the highest score between:

0.30 × p1 + 0.70 × jan

1.00 × jan

The mark of *General Chemistry* part in the second call comes from the first partial (p1) and the recovery exam (jun) in June as the highest score between:

0.30 × p1 + 0.70 x jun

1.00 × jun

Organic Chemistry part:

The first call for *Organic Chemistry* part will have two exams: a partial exam (January) and a second cumulative exam of the whole subject in April.

The *Organic Chemistry* mark, in the first call (to be combined with the General Chemistry mark that will be known in January), comes from the first partial exam (p1) mark and the second in April (apr) as the highest score between:

0.30 × p1 + 0.70 × apr

1.00 × apr

The *Organic Chemistry* second call will be in June and the mark will comes from the mark of the first partial (p1) exam and the recovery exam in June (jun) as the highest score between:

0.30 × p1 + 0.70 x jun

1.00 × jun

Students who do not pass the subject globally in the first call, but have a part (General Chemistry or Organic Chemistry) with a mark higher or equal to 5.00, can choose between keeping the mark from the passed part or pass the two parts exam in the second call.

If due to the current situation some activity cannot be developed normally, alternative activities will be carried out in order to evaluate them according to their corresponding qualification weight.

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Organic Chemistry

- ATKINS R.C. *Organic Chemistry: a brief course* – McGraw-Hill **2001**
- BRUICE P.Y. *Química Orgànica* - Pearson Prentice-Hall **2008**
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