

**COURSE DATA****DATA SUBJECT****Code:** 33939**Name:** General Chemistry**Cycle:** Undergraduate Studies**ECTS Credits:** 6**Academic year:** 2025-26**STUDY (S)**

Degree	Center	Acad. year	Period
1205 - Degree in Human Nutrition and Dietetics	Facultat de Farmàcia i Ciències de L'alimentació	1	First quarter

**SUBJECT-MATTER**

Degree	Subject-matter	Character
1205 - Degree in Human Nutrition and Dietetics	Chemistry	BASIC

**COORDINATION**

VERDEJO VIU BEGOÑA

**SUMMARY**

General Chemistry is a basic course taught during the first semester of first year Grade in Human Nutrition and Dietetics. Current study plan (curriculum) includes 4,5 theoretical credits and 1,5 laboratory credits.

The theoretical part attempts to provide the student the concepts and bases of chemistry in general, with special emphasis to those concerning the chemical elements and their compounds, while, at the same time, trying to highlight a scientific vision of reality, a fundamental aspect of university education. Students should achieve solid bases to interpret and build the potential applications and uses of inorganic compounds, not only to undertake the study of other courses with chemical contents, but also in carrying out the different aspects of the professional activities specific to this Grade, in research, teaching or industry.

Concerning theory lectures, they attempt that students consolidate and expand their knowledge on atomic structure, chemical bonding (both, in individual molecules and in solids), stoichiometric relationships, acid-base concepts, oxidation-reduction, and reactivity, as well as those principles determining kinetics and thermodynamic aspects of chemical transformations.

With respect to laboratory work, students should achieve basic technical skills and be able to perform experimental studies concerning some of the concepts covered in the theoretical lectures



## PREVIOUS KNOWLEDGE

### RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

### OTHER REQUIREMENTS

Formulation and stoichiometry basic knowledge

## COMPETENCES / LEARNING OUTCOMES

### 1205 - Degree in Human Nutrition and Dietetics

Acquire basic training for the research activity, be able to formulate hypotheses, collect and interpret information for problem solving using the scientific method, and understand the importance and the limitations of scientific thought in the field of health and nutrition.

Acquire skills for presenting a project orally or in writing.

Communicate effectively, both orally and in writing, with people, with health or industry professionals and with the media, knowing how to use information and communication technologies, especially those related to nutrition and lifestyles.

Develop the ability to estimate the risks associated with the use of chemicals and laboratory processes.

Practise the profession with respect for other health professionals and acquire skills to work in teams.

Recognise the need to maintain and update professional competence, with particular emphasis on independent and lifelong learning of new facts, products and techniques in the field of nutrition and food, and on motivation for quality.

## DESCRIPTION OF CONTENTS

### 1. INTRODUCTION TO THE STUDY OF CHEMISTRY

Branches of Chemistry. Physical and chemical, intensive and extensive properties of matter. Classification of matter. Treatment of measurements in chemistry. Atomic composition. Atomic nucleus. Isotopes. The concept of bonding and its different types. Electronegativity and bond polarity. The chemical reaction. Stoichiometric calculations. Limiting reagent and percent yield of chemical reactions.



## 2. THERMOCHEMISTRY AND THERMODYNAMICS

Energy, heat, and work. Principles of thermodynamics. State functions. Enthalpy of physical and chemical changes. Hess's law. Enthalpy of formation. Entropy. Gibbs free energy. Criteria of spontaneity of chemical changes.

## 3. SOLUTIONS

Intermolecular forces: Van der Waals forces. Hydrogen bond. Physical states of matter: gases, liquids, and solids. Spontaneity of the dissolution process. Dissolution of solids in liquids. Solubility rules. Dissolution of liquids. Dissolution of gases. Saturation. Solubility and solubility product. Effect of temperature on solubility. Molarity; mole fraction; percentage of solute w/w, w/v, v/v; normality. Equivalent. Colligative properties of solutions: vapor pressure depression, boiling-point increase, freezing-point depression, osmotic pressure. Osmolarity. Iso- hyper- and hypotonic solutions. Colligative properties and dissociation of electrolytes. Colloids. Tyndall effect. Hydrophilic and hydrophobic colloids.

## 4. CHEMICAL EQUILIBRIUM

Reversibility and dynamic nature of chemical equilibrium. Equilibrium spontaneity. Thermodynamic aspects of chemical equilibrium. Equilibrium constant and reaction quotient. Homogeneous and heterogeneous equilibria. Factors affecting chemical equilibria. Le Chatelier's law. Free energy and equilibrium constant.

## 5. ACID-BASE EQUILIBRIA

Acid-Base concepts: Arrhenius, Bronsted and Lewis. Bronsted acids and bases in water. Neutralization. Acid-base character of oxides. Water autoionization;  $K_w$ . Strength of acids and bases. Acid-base equilibrium constant:  $K_a$  ( $pK_a$ ),  $K_b$  ( $pK_b$ ),  $K_w$  ( $pK_w$ ). Leveling and differentiating effects of solvent. Molecular structure and acid strength. Polyprotic acids. Definition of pH and pH scale. pH calculations. Acid-base indicators. Acid-base titration curves. Buffer solutions. Hydrolysis. Acid-base character of aqueous solutions of salts.



## **6. REDOX EQUILIBRIA**

Oxidation and reduction concepts. Redox reactions. Half-reactions. Electrochemical cells. Cell potential and free energy of redox reactions. Electrode potentials. Electrochemical series and activity of elements. Nerst equation. Systematic methods for balancing redox reactions: The ion-electrode method; the Valence Change Method.

## **7. ATOMIC STRUCTURE**

Quantum-mechanical atomic model. The Schrodinger equation for the hydrogen atom. Quantum numbers and atomic orbitals. Polyelectronic atoms. Electronic configuration. The Periodic Table. Periodicity.

## **8. THE CHEMICAL BOND**

Covalent bond. Lewis structures. Resonance. Molecular geometry: the VSEPR model. Molecular Orbital Theory.

## **9. CHEMICAL KINETICS**

Basic concepts: rate of reaction, rate equation, order of reaction. Elementary reactions. Molecularity of elementary reactions. Net reaction. Rate determining step. Reaction mechanism. Activation energy. Activated complex or transition state. Stationary state approach. Effect of temperature on the rate of reaction. Catalysis.

## **10. LABORATORY SESSION 1: INTRODUCTION TO LABORATORY TECHNIQUES**

- A. Basic material of laboratory. Products labelling and transferring samples weight. Measure of liquid volums. Burette utilization.
- B. Preparation of solutions.



## 11. LABORATORY SESSION 2: SAMPLES SEPARATION

- A. Separation milk casein and identification of serum components.
- B. Distillation of a commercial wine.

## 12. LABORATORY SESSION 3: ACID-BASE EQUILIBRIA.

- A. Potentiometric titration of acetic acid.
- B. Determination of acidity of a commercial vinegar.
- C. Buffer solutions.

## 13. LABORATORY SESSION 4: REDOX EQUILIBRIA

- A. Redox reactions. Batteries.
- B. SO<sub>2</sub> titration in wines.

## WORKLOAD

### PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	2,00
Theory	38,00
Seminar	2,00
Laboratory	15,00
<b>Total hours</b>	<b>57,00</b>

### NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	8,00
Independent study and work	21,00
Preparation of lessons	45,00
Preparation for assessment activities	10,00
Resolution of case studies	6,00
<b>Total hours</b>	<b>90,00</b>



## TEACHING METHODOLOGY

This course is structured in three types of activities: theory lectures, tutorials (recitations), seminars, and laboratory sessions.

Study of theory contents. Students should acquire the basic knowledge included in the syllabus by means of their individual study and assistance to the lectures. During such lectures, the professor will set and explain a global perspective of each subject, will emphasize the key concepts needed for its understanding, and will answer questions from the students. To help in their individual study and in depth preparation of each subject, students will be provided with basic and complementary bibliography, internet addresses and supporting computer equipment, as well as the instructions and advice for handling information sources.

During the development of theoretical and practical activities, different examples regarding the applicability of the items studied in the course to the Sustainable Development Goals (SDG) will be pointed out. The proposed subjects for the preparation of the Coordinated Seminars will be also linked to the SDG. It is pursued to provide to the students, knowledge, abilities and motivation to understand and face the above-mentioned SDG, meanwhile reflection and critical thinking are promoted.

Laboratory work. Laboratory sessions are structured around four main components. In the first place, students must undertake a preparatory work before going to the laboratory, consisting in an effort to understand the laboratory guide provided for each experiment, review of the theoretical concepts involved, answering a set of previous questions, and preparing an outline of work process. During lab attendance, the professor will make a brief explanation of the keys aspects of the experimental work to be undertaken and will assist and monitor the students during the session. The student should analyze the observed facts and will answer some post-laboratory questions. By the end of the course all students will take a written exam on some questions directly related with the carried-out experiments.

Tutorials. During tutorials are meant to solve any doubt raised during theory lectures and to orient students about the most effective work methodology to improve their learning performance.

Coordinated Seminars. Students may have to prepare and make an oral presentation of a work on a subject of current interest relative to the course outline.

Seminars, practical sessions, and tutorials are mandatory for all students. Failure to attend seminars and tutorials will have a negative impact on the final grade, while unjustified absence from any of the practical sessions will result in failure of the course.

In the case of students who have enrolled for the second time or in successive exam sessions, it will be mandatory to attend all face-to-face training activities again, including laboratory practicals and tutorials. Grades and attendance from previous courses will not be retained, and it will be necessary to complete and pass all the activities of the current academic year in order to be assessed, together with the theoretical part.

## EVALUATION



Learning evaluation of students will take into account all aspects exposed in the methodology section of this teaching guide and will be carried out by the professor in a continuous way.

Final grade will be calculated by weighing 75% the score assigned by the professor in evaluating the exams, and participation in lectures, tutorials, and seminar (Th) (in the theory part  $\hat{i}Th\hat{i}$ , the participation represents a 15% and the exam a 85%, but a minimum score of 5 over 10 is required in the exam).

The evaluation of the coordinated seminar will be conducted following the regulations specified on the degree programme website.

The score obtained in the laboratory work (Lab) will represent a 15% of the final grade. Finally, the grade obtained in the coordinated seminar (CSem) will represent a 10% of the final grade:

$$\text{Final grade (score)} = 0.75Th + 0.15Lab + 0.1CSem$$

In order to pass the course, a minimum score of 5 over 10 is required, both in the final exam as well as in the laboratory work.

Students who do not achieve the minimum grade in the theory or laboratory part in the first call, must do an exam about the corresponding part in the second call, which will have the same characteristics as the first one. For the calculation of the total mark, the participation and seminar scores will also be considered.

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## REFERENCES

- QUÍMICA. Chang R. Ediciones McGraw-Hill. Décima edición, 2010. QUÍMICA. La Ciencia Central. Brown T.L., Lemay H.E., Bursten B. E. y Murphy C. J. Editorial Pearson. Décimoprimera edición. 2009. QUÍMICA GENERAL Enlace Químico y Estructura de la Materia. Petrucci R.H., Harwood, W. S. y Herring F.G. Prentice Hall. Octava edición, 2003.(Vol.I)
- QUÍMICA GENERAL Reactividad química. Compuestos inorgánicos y orgánicos. Petrucci R.H., Harwood, W.S. y Herring F.G. Prentice Hall. Octava edición, 2003.(Vol.II) PRINCIPIOS DE QUÍMICA. Atkins P.W. y Jones L. Editorial Panamericana. Tercera edición, 2005. FUNDAMENTOS DE ENLACE Y ESTRUCTURA DE LA MATERIA. E. Colacio Rodríguez. Base Universitaria, Anaya, 2004.