

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

Code	36361
Name	Chemistry
Cycle	Grade
ECTS Credits	6.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. Period year
1212 - Degree in Gastronomic Sciences	Faculty of Pharmacy and Food Sciences	1 First term

Subject-matter

Degree	Subject-matter	Character
1212 - Degree in Gastronomic Sciences	4 - Chemistry	Basic Training

Coordination

Name	Department
ALBELDA GIMENO, MARIA TERESA	320 - Inorganic Chemistry

SUMMARY

General Chemistry is a basic course taught during the first semester of first year Grade in Gastronomical Sciences. 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, with an special focus in the components of foods. At the same time, it is our interest to highlight a scientific vision of reality, a fundamental aspect of university education. Students should achieve solid bases to enterpret and build the potential applications and uses of the chemical compounds that are components of foods, 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.

Concerning classroom 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, applied at the chemical components of foods



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, as well as notions of connection and structure of matter.

OUTCOMES

1212 - Degree in Gastronomic Sciences

- Know the structure and properties of biological macromolecules and their relationship with the function that they perform.
- Students must have acquired knowledge and understanding in a specific field of study, on the basis of general secondary education and at a level that includes mainly knowledge drawn from advanced textbooks, but also some cutting-edge knowledge in their field of study.
- Students must have the ability to gather and interpret relevant data (usually in their field of study) to make judgements that take relevant social, scientific or ethical issues into consideration.
- Students must be able to communicate information, ideas, problems and solutions to both expert and lay audiences.
- Students must have developed the learning skills needed to undertake further study with a high degree of autonomy.
- Plan, order and channel activities in such a way that unforeseen events are avoided as much as possible, possible problems are foreseen and minimised, and solutions are anticipated.
- Acquire the basic training needed to formulate hypotheses, gather and interpret information for solving problems using the scientific method, and understand the importance and the limitations of scientific thinking.
- Learn the fundamentals for using the scientific equipment directly related to professional activity.
- Be able to engage in new fields of gastronomy in general through independent study.
- Be able to work in a team and to organise and plan activities, always taking account of gender perspective.
- Resolve tasks or carry out work in the time allotted while maintaining the quality of the result.



- Be able to distribute time appropriately for carrying out individual or group tasks.
- Be able to take the approaches required to reduce a problem to a manageable level.
- Know the chemical principles of application in gastronomy.

LEARNING OUTCOMES

- Understanding of the atomic structure, chemical bonding (both in molecules and in solid state), stoichiometry, chemical equilibrium, acid-base, redox, chemical reactivity, and chemical transformations (kinetics and Thermodynamics)
- Understanding of the physicochemical properties of food
- knowledge of changes underwent by food during processing

DESCRIPTION OF CONTENTS

1. CHEMISTRY IN THE KITCHEN: A HISTORICAL PERSPECTIVE

First cooking. Development of culinary gastronomy. Culinary science. Science and Cooking: a conversation. Scientists. Gastronomy. Chemistry and kitchen.

2. STRUCTURE OF MATTER

Inside the atom. The atomic nucleus. Isotopes. Quantum model for the atom. Schrödinger equation for the hydrogen atom. Electronic configurations. The periodic table of elements. Periodicity. Periodic properties.

3. CHEMICAL BONDING. MOLECULES AND INTERMOLECULAR FORCES

Introduction to the Chemical bonding. Chemical bonding and energetic stability. Ionic bonding. Covalent bonding. Metallic bonding. Characteristics of ionic, covalent and metallic compounds. Intermolecular forces. States of matter. Disperse systems: gels, emulsions and foams

4. WATER

Water in the kitchen. Structure of water. Properties of water. Water as solvent. Acidity and alkalinity. pH



5. FOOD MOLECULES (I)

Food chemistry: nutrition and biomolecules. Functional groups. Chemical structure of molecules and food: aminoacids and proteins. Denaturation of proteins

6. FOOD MOLECULES (II)

Food chemistry: carbohydrates and lipids

7. CHEMICAL CHANGES IN FOOD

Chemical reactions. Basic concepts: speed of reaction, speed equation and reaction order. Reaction mechanisms. Temperature effect on reaction speed. Activation energy. Catalysis. Redox reactions. Hydrolysis of sugars. Maillard reactions. Caramelization reactions. Browning reactions. Fat oxidation. Hydrogenation of fatty acids. Trans fats. Fruit ripening. Fermentation

8. ADDITIVES

Definition and classification of chemical additives. Preservatives. Substances responsible for smell and taste. Additives for colour modification. Additives for texture modification. Other types of additives.

9. LABORATORY SESSIONS

BASIC LABORATORY MATERIALS AND PREPARATION OF SOLUTIONS

Use of laboratory equipment.

Basic operation of chemical reagents, waste and safety procedures

Preparation of solutions

SEPARATION OF MIXTURES.

Basic laboratory techniques: mass and volumen measurements, filtration, separation, centrifugation, etc.

ACID-BASE EQUILIBRIA. BUFFER SOLUTIONS.

pH determination of foods

Potentiometric titration of acetic acid.

Determination of acidity of commercial vinegar.

Determination of milk acidity.

Preparation of buffer solutions and testing its buffer capacity.

REDOX REACTIONS.

electrochemical cell

Redox reactions in test tube

SO₂ determination

**WORKLOAD**

ACTIVITY	Hours	% To be attended
Theory classes	45,00	100
Laboratory practices	15,00	100
Development of group work	4,00	0
Development of individual work	4,00	0
Study and independent work	15,00	0
Readings supplementary material	6,00	0
Preparation of evaluation activities	10,00	0
Preparing lectures	30,00	0
Preparation of practical classes and problem	15,00	0
Resolution of case studies	6,00	0
TOTAL	150,00	

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. It is intended that the classes be dynamic so that debates or discussions of topics that may be of interest to the subject will begin.

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. Evaluation activities will also be included: comparative exercises, delivery of discussed articles, small questionnaires...

Attendance to seminars, laboratory sessions and tutorials is mandatory. Missing seminar and tutorial attendance will have a negative impact on the final grade. Missing any of the laboratory session will prevent passing the course.

EVALUATION

To pass the subject it is necessary to obtain a grade of 5 points out of 10 both in the theoretical part (Theory) and in the laboratory practices (Laboratory).

In the mark of the Laboratory section, the degree of preparation of the practices (previous tests), the work in the laboratory (notebook and deliverable tasks) and the mark of the final practice exam will be taken into account. All this will mean 15% of the final grade for the subject, provided that a minimum value of 5 is reached.

Laboratory grade = $[0.33 \times \text{practical preparation}] + [0.33 \times \text{laboratory work}] + [0.33 \times \text{final laboratory practical exam}]$

There will be a partial exam of the subject to evaluate the contents taught so far. Said exam will mean 30% of the grade for the Theory section and the elimination of that part of the subject in the final exam as long as the grade obtained is higher than 4/10.

Theory Note = $[0.30 \times \text{Partial Exam}] + [0.70 \times \text{Final Exam}]$

The note corresponding to the continuous evaluation section will include the qualification of deliverable tasks, questionnaires carried out in class, participation in debates, etc.

The final mark of the subject will be composed of: the mark obtained in the Theory section (70%), the mark obtained in the Laboratory section (15%) and the mark of the continuous evaluation (15%).

Final Grade = $[0.70 \times \text{Theory}] + [0.15 \times \text{Laboratory}] + [0.15 \times \text{Continuous Evaluation}]$

Finally, carrying out a piece of work and exposing it (optional work) will allow the final mark to be increased up to one point in addition to the final mark, as long as it reaches a minimum value of 4.5.

REFERENCES

Basic

- 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)
- FOOD: THE CHEMISTRY OF ITS COMPONENTS. Coultate, T. P., Royal Society of Chemistry, Fourth Edition, London, 2002



Additional

- 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)
- LA COCINA Y LOS ALIMENTOS. McGee, H., Debate, Barcelona, 2007.