# COURSE DATA

| Data Subject | |
|---|---|
| **Code** | 36361 |
| **Name** | Chemistry |
| **Cycle** | Grade |
| **ECTS Credits** | 6.0 |
| **Academic year** | 2023 - 2024 |

**Study (s)**

| Degree | Center | Acad. year | Period |
|---|---|---|---|
| 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

- Undestanding of the atomic structure, chemical bonding (both in molecules and in solid state), stequiometry, chemical equilibrium, acid-base, redox, chemical reactivity, and chemical transformations (kinetics and Thermodynamics)

- Undestanding 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. Metalic 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 alcalinity. 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. Hydrolisis 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

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

The grade in the laboratory section will include the score of some tests taken before each practice that will measure the degree of preparation of the practice, the work done in the laboratory (notebook and deliverable tasks), and the mark of the final exam of practices. All this will mean a 15% of the final grade of the subject, as long as a minimum value of 5 is reached.

Laboratory grade = [0.33 x practical preparation] + [0.33 x laboratory work] + [0.33 x final laboratory practical exam].

There will be a final exam of the course whose mark will be the grade of the Theory section.

The grade corresponding to the continuous evaluation section will include the score of deliverable tasks, questionnaires, participation in debates and forums, etc.

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

Final grade = [0.70 x Theory] + [0.15 x Laboratory] + [0.15 x Continuous evaluation].

Finally, the realization of a work and the exposition of the same (optional work) will allow to increase the final grade up to an additional point to the final grade if **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.