# COURSE DATA

| Data Subject | |
|---|---|
| **Code** | 36361 |
| **Name** | Chemistry |
| **Cycle** | Grade |
| **ECTS Credits** | 6.0 |
| **Academic year** | 2021 - 2022 |

**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

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

The internship grade will take into account the degree of preparation for the internship, the work in the laboratory and the grade of the final internship exam. All this will mean 15% of the final grade of the subject, provided that a minimum value of 5 is reached.

There will be a partial examination of the subject to evaluate the contents taught so far. This examination will suppose the elimination of that part of the matter in the final examination as long as the mark obtained is superior to 4/10. The mark corresponding to the theoretical exam section will be composed by the average of both exams (partial and final).

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

The final mark of the subject will be composed by: the qualification obtained in the section theoretical examination (70%), the qualification obtained in the laboratory practices (15%) and the note of the continuous evaluation (15%).

Final Grade = [0.70 x Exam] + [0.15 x Laboratory] + [0.15 x Continuous Assessment]

Finally, the realization of a work and the exhibition of the same (Optional work) will allow to increase the final note until an additional point to the final note, always when this reaches a minimum value of 4.

## 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.

## ADDENDUM COVID-19

**This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council**

This addendum will only be activated if the health situation requires it and with the prior agreement of the Governing Council.

2. Workload and temporary planning of teaching

It does not change. All evaluable activities will be carried out respecting the workload of the teaching guide and the schedules established in the academic calendar.

3. Teaching methodology

Theory sessions. They will be carried out in person (if the health situation allows it) and virtually through videoconferencing (Blackboard), chats, powerpoint presentations or pdf documents, respecting the schedule of the subject. All the necessary documentation for the follow-up of the classes, as well as the specific documentation, will be accessible to the Virtual classroom of the subject.

Practice sessions. The practices will be developed in person. In case the practices cannot be carried out in person, the same virtual media will be used asynchronously that are used in the theory sessions, combining the visualization of didactic videos with different learning tools included in the virtual classroom.

4. Evaluation

Neither the way of evaluating nor the weighting of each evaluable part with respect to the information contained in the Teaching Guide of the subject does not change.