UNIVERSIDAD DE CASTILLA - LA MANCHA

GUÍA DOCENTE

1. General information

Course:	GENERAL CHEMISTRY	**Code:**	58338
Type:	BASIC	**ECTS credits:**	12
Degree:	383 - UNDERGRADUATE DEGREE PROGRAMME IN FOOD SCIENCE AND TECHNOLOGY	**Academic year:**	2023-24
Center:	1 - FACULTY OF SCIENCE AND CHEMICAL TECHNOLOGY	**Group(s):**	22
Year:	1	**Duration:**	AN
Main language:	Spanish	**Second language:**	English
Use of additional languages:		**English Friendly:**	Y
Web site:		**Bilingual:**	N

Lecturer: **BERNABE BALLESTEROS RUIZ** - Group(s): **22**

Building/Office	Department	Phone number	Email	Office hours
Marie Curie, primera planta	QUÍMICA FÍSICA	926052049	bernabe.ballesteros@uclm.es	Mon.,Tues.: 9-11h Thurs.: 17-19h

Lecturer: **ENRIQUE DIEZ BARRA** - Group(s): **22**

Building/Office	Department	Phone number	Email	Office hours
San Alberto Magno	QUÍMICA INORG., ORG., Y BIOQ.	926295337	enrique.diez@uclm.es	Monday-thursday 17-19 h

Lecturer: **GEMA DURA GRACIA** - Group(s): **22**

Building/Office	Department	Phone number	Email	Office hours
Edificio San Alberto Magno (primer piso)	QUÍMICA INORG., ORG., Y BIOQ.		Gema.Dura@uclm.es	Monday-Thursday 18-19

Lecturer: **MARÍA VICTORIA GÓMEZ ALMAGRO** - Group(s): **22**

Building/Office	Department	Phone number	Email	Office hours
IRICA	QUÍMICA INORG., ORG., Y BIOQ.	926052633	MariaVictoria.Gomez@uclm.es	Monday-thursday 17-19 h

Lecturer: **MARIA DEL PILAR PRIETO NUÑEZ-POLO** - Group(s): **22**

Building/Office	Department	Phone number	Email	Office hours
San Alberto Magno	QUÍMICA INORG., ORG., Y BIOQ.	+34926052615	mariapilar.prieto@uclm.es	Monday-thursday 17-19 h

Lecturer: **ELENA VILLASEÑOR CAMACHO** - Group(s): **22**

Building/Office	Department	Phone number	Email	Office hours
Edificio San Alberto Magno (primer piso)	QUÍMICA INORG., ORG., Y BIOQ.	926052133	elena.villasenor@uclm.es	Monday-thursday 17-19 h

2. Pre-Requisites

There are no prerequisites for this subject, although it is recommended that the student has studied chemistry in high school. Likewise, it would be advisable for the student to know the nomenclature of inorganic compounds, according to IUPAC rules, as well as the most common traditional formulations, and the physical-chemical magnitudes and the units.

3. Justification in the curriculum, relation to other subjects and to the profession

The student of Food Science and Technology degree must acquire the conceptual, manual and technical tools that allow him/her to exercise in an important field within the food industry. To do so, it is essential that they acquire a solid knowledge of the fundamentals and bases of Chemistry. The subject of General Chemistry aims to help students to understand in depth the chemical concepts they have acquired during their secondary education, to complete them and to acquire the necessary skills for their application to the practical cases that will be presented, both in their future professional life and when studying other subjects of the curriculum. Specifically, this course will deal with the description of chemical bonding and the study of chemical reactions, stoichiometry, the structure of matter, as well as the periodic properties of the elements.

General Chemistry is an annual basic subject, which will be taught in the first year and is an essential starting point for the proper learning of other subjects of the degree of Food Science and Technology.

4. Degree competences achieved in this course

Course competences

Code	Description
CB01	Prove that they have acquired and understood knowledge in a subject area that derives from general secondary education and is appropriate to a level based on advanced course books, and includes updated and cutting-edge aspects of their field of knowledge.
E01	To acquire basic knowledge in chemistry, mathematics, physics to allow the study of the nature of foods, causes of their alteration and fundamentals of their production processes
E03	To know and be able to apply fundamentals of chemistry, as well its applications in analytical chemistry, organic chemistry, physical chemistry and inorganic chemistry in the field of the Food Science and Technology
E05	To know the composition, phyco-chemical properties, nutritional value and sensory properties of foods
	To develop the aptitude to gather and interpret information and data to issue critical judgments that include a reflection on relevant

G01	topics of social, scientific or ethical nature.
G02	To possess a correct oral and written communication. To transmit information, ideas, problems and solutions to a both specialized and not specialized public.
G04	To develop the necessary skills of learning to undertake later studies with a high degree of autonomy.
G07	To possess ability of organization and planning, initiative, entrepreneurship and aptitude to be employed in teamworks. To possess capacity of resolution of specific problems of the professional area and to develop the critical reasoning and decision making.
G08	To know the principles and the theories of Basic Science as well as the methodologies and applications of the chemistry, physics, biology and mathematics that are necessary to acquire the specific knowledge of the Degree.

5. Objectives or Learning Outcomes

Course learning outcomes

Description

To ensure that the student acquires the basic terminology of Chemistry and knows how to use it, as well as being able to establish relationships between the different concepts.

Having a basic knowledge of some electrochemical phenomena and their applications

Know the different units correctly.

Know the basic concepts and principles of Chemistry, so that the essential foundations are laid so that they can successfully face the study of the different branches of the discipline.

Know the fundamentals of molecular structure, chemical thermodynamics and chemical kinetics.

Homogenize the knowledge of Chemistry already acquired by students in the Middle Education courses and complete certain aspects that have not been previously studied with the necessary depth.

Learn to work autonomously in a laboratory and know how to interpret the experimental results obtained.

6. Units / Contents

Unit 1: Chemical formulation. Chemical reactions and equations. Stoichiometry. Concentration units. Limiting reagent. Reaction yields

Unit 2: Origins of the quantum theory of the atom. Electrical nature of matter: Thomson and Mullikan experiments. Fundamental particles: electrons, protons and neutrons. Rutherford's atomic model. The atomic nucleus. Dual nature of electromagnetic radiation: Planck equation. Dual nature of matter: de Broglie hypothesis. Uncertainty principle. Bohr's atomic model. Atomic spectra: hydrogen emission spectrum.

Unit 3: Atomic structure. Schrödinger equation: wave function. Probability. Solution of the wave equation for hydrogenoid atoms. Quantum numbers and atomic orbitals. Physical meaning and graphical representations of the orbitals of the hydrogen atom. Polyelectronic atoms.

Unit 4: Periodic properties of the elements. Introduction. Pauli exclusion principle. Auf-Bau principle and electronic configurations. Hund's rule. Periodic classification of the elements: Periodic table. Periodic properties: atomic radii. Ionisation potentials. Electronic affinity.

Unit 5: Molecular structure: Covalent bonding. Introduction to chemical bonding. Method of approach to molecular geometry: Lewis structures. Valence bond theory. Hybridisation. Theory of molecular orbitals. Application to homonuclear diatomic molecules of second period elements. Application to diatomic heteronuclear molecules of the second period. Ionic character of a covalent bond: electronegativity, Pauling scale. Intermolecular forces: van der waals forces and hydrogen bridges

Unit 6: Solid state: Ionic and metallic bonding. Introduction. Types and properties of crystalline solids: molecular solids, covalent solids, ionic solids and metallic solids. Crystal structure of ionic solids. Ionic radii. Reticular energy: Born-Haber cycle and Born-Landé equation. Polarisation and covalent character of the ionic bond. Fajans' rules. Introduction to metallic bonding.

Unit 7: Gases. Pressure of a gas. Gas laws: Boyle's Law, Charles and Gay-Lussac's Law, Avogadro's Law. Absolute temperature scale. Ideal gas equation. Determination of molecular weights and formulas. Dalton's law of partial pressures. Kinetic theory of gases. Graham's law: diffusion and effusion of gases. Real gases

Unit 8: Chemical Thermodynamics. Work. Heat and its measurement. First Law of Thermodynamics: internal energy. Enthalpy and heat. Thermochemistry: enthalpies of reaction, formation and combustion. Hess's law. Binding energy. Heat capacity. Second Law of Thermodynamics. Spontaneous processes and entropy. Gibbs free energy.

Unit 9: Solutions. Ideal solutions (non-volatile solutes). Raoult's Law. Colligative properties: non-ideal solutions (Henry's law). Introduction to electrolyte solutions: interactions between ionic solutes and water (strong and weak electrolytes); activity and activity coefficient; properties of the activity coefficients

Unit 10: Chemical equilibrium (gas phase equilibria) equilibria in solution. Reversible and irreversible reactions. Equilibrium state characteristics Free energy and equilibrium constant Concentration and equilibrium constant Relationship between the different chemical equilibrium constants for a homogeneous gaseous system. Factors affecting the equilibrium position (temperature, concentration, pressure). Acid-base equilibrium. Volumetry.

Unit 11: Introduction to the laboratory. Safety in the laboratory. The laboratory notebook. Laboratory materials. Preparation of solutions. Precipitation and crystallisation. Filtration techniques Separation of liquids by distillation Recrystallisation of organic products Determination of melting point. Chromatographic techniques. Thin Layer and Column Chromatography. Extraction of caffeine from different sources.

7. Activities, Units/Modules and Methodology

Training Activity	Methodology	Related Competences (only degrees before RD 822/2021)	ECTS	Hours	As	Com	Description
Class Attendance (theory) [ON-SITE]	Combination of methods	E01 G04 G08	1.76	44	N	-	
Workshops or seminars [ON-SITE]	Project/Problem Based Learning (PBL)	CB01 E01 E03 G01 G02 G04 G08	1.24	31	Y	N	
Class Attendance (practical) [ON-SITE]	Practical or hands-on activities	E01 E03 G04 G08	1.52	38	Y	Y	
Study and Exam Preparation [OFF-SITE]	Self-study	E01 G04	1.6	40	N	-	
Mid-term test [ON-SITE]	Assessment tests	CB01 E03 G01 G02	0.28	7	Y	N	
Other off-site activity [OFF-SITE]	Self-study	G04 G07	5.6	140	N	-	
		Total:	**12**	**300**			
		Total credits of in-class work: 4.8					**Total class time hours: 120**
		Total credits of out of class work: 7.2					**Total hours of out of class work: 180**

As: Assessable training activity

Com: Training activity of compulsory overcoming (It will be essential to overcome both continuous and non-continuous assessment).

8. Evaluation criteria and Grading System

Evaluation System	Continuous assessment	Non-continuous evaluation*	Description
Assessment of problem solving and/or case studies	20.00%	0.00%	The resolution of the problems by the student will be positively assessed, as well as their active participation in class, and the completion of the continuous assessment activities proposed by the teaching staff.
Laboratory sessions	20.00%	20.00%	Attendance at all practical laboratory classes is mandatory. The skill acquired in the handling of chemical substances as well as of the laboratory material, the student's attitude and the adequate elaboration of the laboratory notebook will be valued. To pass the course it will be essential to have carried out and approved the laboratory practices and the test.
Mid-term tests	60.00%	80.00%	There will be a progress test at the end of each term, compulsory to pass the course by continuous assessment, in which the student must demonstrate that he has acquired the corresponding knowledge.
Total:	**100.00%**	**100.00%**	

According to art. 4 of the UCLM Student Evaluation Regulations, it must be provided to students who cannot regularly attend face-to-face training activities the passing of the subject, having the right (art. 12.2) to be globally graded, in 2 annual calls per subject , an ordinary and an extraordinary one (evaluating 100% of the competences).

Evaluation criteria for the final exam:

Continuous assessment:

Students who pass the two continuous evaluations, the formulation test, and laboratory practices, will pass the course through continuous assessment. In order to obtain an average mark, it will be necessary to obtain a 4 in each partial test. The pass mark for the course is 5. There will be a first mid-term at the end of the first term and a second on the date set for the ordinary exam.
In the ordinary call, the student who follows the continuous assessment will only have to take the exam of the parts not passed (first mid-term and/or the formulation test).

Non-continuous evaluation:

Students who do not follow continuous assessment must justify this to the teaching staff at the beginning of the course by the procedure determined by the Faculty. This student will has the right to be evaluated in the progress tests at the end of each term or in a final test in the ordinary call, in which he will have to pass all the competences of the subject. In both cases, the student will have to pass the formulation, and laboratory practices.

Specifications for the resit/retake exam:

The student who has passed the formulation exam, the laboratory practices, or any continuous evaluation in the ordinary call, will not have to re-examine the parts passed in this call.

Specifications for the second resit / retake exam:

The student will take an exam on the global of the subject.

9. Assignments, course calendar and important dates

Not related to the syllabus/contents	
Hours	**hours**
Study and Exam Preparation [AUTÓNOMA][Self-study]	26
Mid-term test [PRESENCIAL][Assessment tests]	7
Unit 1 (de 11): Chemical formulation. Chemical reactions and equations. Stoichiometry. Concentration units. Limiting reagent. Reaction yields	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Combination of methods]	3
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	7
Study and Exam Preparation [AUTÓNOMA][Self-study]	24
Unit 2 (de 11): Origins of the quantum theory of the atom. Electrical nature of matter: Thomson and Mullikan experiments. Fundamental particles: electrons, protons and neutrons. Rutherford's atomic model. The atomic nucleus. Dual nature of electromagnetic radiation: Planck equation. Dual nature of matter: de Broglie hypothesis. Uncertainty principle. Bohr's atomic model. Atomic spectra: hydrogen emission spectrum.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Combination of methods]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	4
Unit 3 (de 11): Atomic structure. Schrödinger equation: wave function. Probability. Solution of the wave equation for hydrogenoid atoms. Quantum numbers and atomic orbitals. Physical meaning and graphical representations of the orbitals of the hydrogen atom. Polyelectronic atoms.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Combination of methods]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	4
Unit 4 (de 11): Periodic properties of the elements. Introduction. Pauli exclusion principle. Auf-Bau principle and electronic configurations. Hund's rule. Periodic classification of the elements: Periodic table. Periodic properties: atomic radii. Ionisation potentials. Electronic affinity.	
Activities	**Hours**
Class Attendance (theory) [PRESENCIAL][Combination of methods]	3
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	14
Unit 5 (de 11): Molecular structure: Covalent bonding. Introduction to chemical bonding. Method of approach to molecular geometry: Lewis structures. Valence bond theory. Hybridisation. Theory of molecular orbitals. Application to homonuclear diatomic molecules of second period elements. Application to diatomic heteronuclear molecules of the second period. Ionic character of a covalent bond: electronegativity, Pauling scale. Intermolecular forces: van der waals forces and hydrogen bridges	

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Combination of methods]	6
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	5
Study and Exam Preparation [AUTÓNOMA][Self-study]	22

Unit 6 (de 11): Solid state: Ionic and metallic bonding. Introduction. Types and properties of crystalline solids: molecular solids, covalent solids, ionic solids and metallic solids. Crystal structure of ionic solids. Ionic radii. Reticular energy: Born-Haber cycle and Born-Landé equation. Polarisation and covalent character of the ionic bond. Fajans' rules. Introduction to metallic bonding.

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Combination of methods]	4
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	12

Unit 7 (de 11): Gases. Pressure of a gas. Gas laws: Boyle's Law, Charles and Gay-Lussac's Law, Avogadro's Law. Absolute temperature scale. Ideal gas equation. Determination of molecular weights and formulas. Dalton's law of partial pressures. Kinetic theory of gases. Graham's law: diffusion and effusion of gases. Real gases

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Combination of methods]	4
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	2
Study and Exam Preparation [AUTÓNOMA][Self-study]	12

Unit 8 (de 11): Chemical Thermodynamics. Work. Heat and its measurement. First Law of Thermodynamics: internal energy. Enthalpy and heat. Thermochemistry: enthalpies of reaction, formation and combustion. Hess's law. Binding energy. Heat capacity. Second Law of Thermodynamics. Spontaneous processes and entropy. Gibbs free energy.

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Combination of methods]	5
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	5
Study and Exam Preparation [AUTÓNOMA][Self-study]	21

Unit 9 (de 11): Solutions. Ideal solutions (non-volatile solutes). Raoult's Law. Colligative properties: non-ideal solutions (Henry's law). Introduction to electrolyte solutions: interactions between ionic solutes and water (strong and weak electrolytes); activity and activity coefficient; properties of the activity coefficients

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Combination of methods]	3
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	3
Study and Exam Preparation [AUTÓNOMA][Self-study]	12

Unit 10 (de 11): Chemical equilibrium (gas phase equilibria) equilibria in solution. Reversible and irreversible reactions. Equilibrium state characteristics Free energy and equilibrium constant Concentration and equilibrium constant Relationship between the different chemical equilibrium constants for a homogeneous gaseous system. Factors affecting the equilibrium position (temperature, concentration, pressure). Acid-base equilibrium. Volumetry.

Activities	Hours
Class Attendance (theory) [PRESENCIAL][Combination of methods]	5
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	9
Study and Exam Preparation [AUTÓNOMA][Self-study]	29

Unit 11 (de 11): Introduction to the laboratory. Safety in the laboratory. The laboratory notebook. Laboratory materials. Preparation of solutions. Precipitation and crystallisation. Filtration techniques Separation of liquids by distillation Recrystallisation of organic products Determination of melting point. Chromatographic techniques. Thin Layer and Column Chromatography. Extraction of caffeine from different sources.

Activities	Hours
Class Attendance (practical) [PRESENCIAL][Practical or hands-on activities]	40

Global activity

Activities	hours
Workshops or seminars [PRESENCIAL][Project/Problem Based Learning (PBL)]	36
Class Attendance (practical) [PRESENCIAL][Practical or hands-on activities]	40
Study and Exam Preparation [AUTÓNOMA][Self-study]	180
Mid-term test [PRESENCIAL][Assessment tests]	7
Class Attendance (theory) [PRESENCIAL][Combination of methods]	37
Total horas:	300

10. Bibliography and Sources

Author(s)	Title/Link	Publishing house	Citv	ISBN	Year	Description
Chang, Raymond	Química	McGraw-Hill		978-607-15-0928-4	2013	
Brown, Lemay, Bursten, Murphy, Woodward	Química. La Ciencia Central	Pearson		978-607-32-2237-2	2014	
Domínguez Reboiras, Miguel Ángel	Química : la ciencia básica	Thomson Paraninfo		978-84-9732-347-5	2008	
Orozco C.; González N.; Pérez A.	Problemas Resueltos de Química Aplicada	Paraninfo		978-84-283-8092-8	2011	
Peterson, W. R.	Formulación y nomenclatura química inorgánica : [según la n	EDUNSA, Ediciones y Distribuciones Universitari		84-85257-04-9	1996	
Petrucci, Ralph H.	Química general (english version)	Pearson-Prentice Hall		978-84-205-3533-3	2010	
Whitten, Kenneth W.	Química general	McGraw-Hill		84-481-1386-1	2002	