

| General information | |
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| Academic subject | General Chemistry |
| Degree course | <i>Food Science and Technology (L26)</i> |
| Academic Year | <i>First</i> |
| European Credit Transfer and Accumulation System (ECTS) | 6 ECTS |
| Language | <i>Italian</i> |
| Academic calendar (starting and ending date) | <i>October 17th, 2022 – February 10th, 2023</i> |
| Attendance | <i>No Compulsory</i> |

| Professor/ Lecturer | |
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| Name and Surname | Roberto terzano |
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| Telephone | 0805442852 |
| Department and address | <i>DiSSPA</i> |
| Virtual headquarters | <i>Microsoft Teams</i> |
| Tutoring (time and day) | Monday on appointment |

| Syllabus | |
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| Learning Objectives | The main objective of the course is to provide students with an adequate knowledge of chemical elements and molecules as well as the main chemical and physico-chemical laws governing the processes of matter transformation. |
| Course prerequisites | |
| Contents | <p>Atoms and molecules Atomic architecture. Electronic structure of atoms. Atomic models. Orbital symbolism. Periodic table and periodic properties. Atomic sizes. Ionization energy, electron affinity and electronegativity. Atomic weight and related quantities. Ions. Molecules. Formula and molecular weight. Avogadro number and mole concept.</p> <p>Chemical bonding Covalent bonding. Electronegativity. Bond polarity and dipolar momentum. Ionic bonding. Coordination bonding. Metallic bonding. Dipole bonding and van der Waals forces. Hydrogen bond. Lewis and valence bonding theories. Multiple bonding. Molecular orbitals. The structure of molecules. VSEPR theory. Hybridization. Resonance and resonance structures.</p> <p>Chemical reactions and stoichiometry Chemical nomenclature of inorganic substances. Oxidation number. Chemical formulas and equations. Stoichiometry. Weight relations in chemical equations. Oxidation-Reduction reactions. Limiting reagent.</p> <p>Gases, solids and liquids Properties. Ideal gases and related equations. Kinetic theory. Gas mixtures and partial pressure of gases. Structural concepts in solids. Types of solids: crystalline and amorphous solids. Vaporization of a liquid. Phase equilibrium diagram. Change of states for water.</p> <p>Solutions Solvent and solute. Nature of solutions and expression of concentration: weight percentage, molar fraction, molarity, ppm and ppb. Chemical equivalent and</p> |

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| | <p>normality. Henry's law. Raoult's law. Colligative properties of solutions. Electrolytes and non electrolytes.</p> <p>Thermodynamics Thermodynamic systems. State functions and form of energy and their equivalence. Thermochemistry. Enthalpy. Entropy. Free energy and spontaneity criteria. Thermodynamics principles.</p> <p>Chemical equilibrium The concept of equilibrium and Le Chatelier principle. Equilibrium constant. Homogeneous and heterogeneous equilibria. The driving force in chemical reactions.</p> <p>Ionic equilibria in water solutions. Water ionization. Acids and bases according to Arrhenius, Brønsted and Lewis definitions. Weak acids and bases. pH and pOH. Polyprotic acids. Anfolites. pH determination of diluted water solutions. Hydrolysis and neutralization. Buffer solutions. Basics of titration and indicators. Solubility and slightly soluble salts. Solubility product and common ion effect.</p> <p>Electrochemistry Galvanic cells and electrolysis. Oxidation-reduction potentials. Electrodes. Daniell's cell. Nernst's equation. pH-meter.</p> <p>Chemical kinetics Reaction rate. Factors affecting the reaction rate. Kinetic order and reaction mechanism. Arrhenius equation. Activation energy and catalysis</p> |
| Books and bibliography | <ul style="list-style-type: none"> • A.M. Manotti Lanfredi e A. Tiripicchio, Fondamenti di Chimica, Casa Editrice Ambrosiana, Milano • P.M. Lausarot, G.A. Vaglio, Stechiometria per la Chimica Generale, Piccin, Bologna • P. Giannoccaro, S. Doronzo, Elementi di Stechiometria, II edizione, Edises, Napoli • P.W. Atkins, General Chemistry, Scientific American Books, U.S.A. • K.W. Whitten et al., General Chemistry, 7th edition, Brooks/Cole Inc. |
| Additional materials | Notes, slides and other bibliographic materials will be furnished during the course |

| Work schedule | | | |
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| Total | Lectures | Hands on (Laboratory, working groups, seminars, field trips) | Out-of-class study hours/Self-study hours |
| Hours | | | |
| 150 | 32 | 28 | 90 |
| ECTS | | | |
| 6 | 4 | 2 | |
| Teaching strategy | | <i>Course contents will be presented through PowerPoint, blackboard and multimedia tools.</i> | |
| Expected learning outcomes | | The expected learning outcomes, in terms of both knowledge and skills, are provided in Annex A of the Academic Regulations of the Degree in Food Science and Technology (expressed through the European Descriptors of the qualification) | |

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| Knowledge and understanding on: | <ul style="list-style-type: none"> ○ Knowledge of the structure of atoms and molecules and the chemical and physico-chemical laws ruling the transformation processes of inorganic and organic substances. |
| Applying knowledge and understanding on: | <ul style="list-style-type: none"> ○ Applying chemical knowledge to understand the energetic and kinetics of matter transformations. |
| Soft skills | <ul style="list-style-type: none"> ● <i>Making informed judgments and choices</i> <ul style="list-style-type: none"> ○ Ability to apply the chemical and physico-chemical laws to understand the transformation and conservation of food and choose the correct procedures. ● <i>Communicating knowledge and understanding</i> <ul style="list-style-type: none"> ○ Ability to describe the constituents of matter and related chemical phenomena ● <i>Capacities to continue learning</i> <ul style="list-style-type: none"> ○ Ability to understand phenomena related to transformation and conservation of food. |
| <p>The expected learning outcomes, in terms of both knowledge and skills, are provided in Annex A of the Academic Regulations of the Degree in Food Science and Technology (expressed through the European Descriptors of the qualification).</p> | |

| Assessment and feedback | |
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| Methods of assessment | <p>The exam consists of a written test and an oral dissertation on the topics developed during the theoretical and theoretical-practical lectures in the classroom, as reported in the Academic Regulations for the Bachelor Degree in Food Science and Technology (article 9) and in the study plan (Annex A). Students attending the lectures may have a middle-term preliminary exam, consisting of a written test, relative to the first part of the program, which will concur to the final evaluation.</p> <p>The evaluation of the preparation of the student occurs on the basis of established criteria, as detailed in Annex B of the Academic Regulations for the Bachelor's degree in food science and Technology.</p> |
| Evaluation criteria | <ul style="list-style-type: none"> ● <i>Knowledge and understanding</i> <ul style="list-style-type: none"> ○ Knowledge of the structure of atoms and molecules and the chemical and physico-chemical laws ruling the transformation processes of inorganic and organic substances. ● <i>Applying knowledge and understanding</i> <ul style="list-style-type: none"> ○ Applying chemical knowledge to understand the energetic and kinetics of matter transformations. ● <i>Autonomy of judgment</i> <ul style="list-style-type: none"> ○ Ability to apply the chemical and physico-chemical laws to understand the transformation and conservation of food and choose the correct procedures. ● <i>Communicating knowledge and understanding</i> <ul style="list-style-type: none"> ○ Ability to describe the constituents of matter and related chemical phenomena. ● <i>Communication skills</i> <ul style="list-style-type: none"> ○ The student will be evaluated considering the use of appropriate technical language. ● <i>Capacities to continue learning</i> <ul style="list-style-type: none"> ○ Ability to understand phenomena related to transformation and conservation of food. |
| Criteria for assessment and attribution of the final mark | <p>The evaluation criteria that contribute to the attribution of the final mark will be:</p> |

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| | knowledge and understanding, the ability to apply knowledge, autonomy of judgment, i.e. the ability to criticize and formulate judgments, communication skills. |
| Additional information | |
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