

Course Unit	Chemistry	Field of study	Physical Sciences
Bachelor in	Environmental Engineering	School	School of Agriculture
Academic Year	2023/2024	Year of study	1
Type	Semestral	Semester	1
Workload (hours)	175,5	Contact hours	T - TP - PL - TC - S - E - OT - O -
		Level	1-1
		ECTS credits	6.5
		Code	9099-814-1105-00-23

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s) Maria João de Almeida Pinto Santos Afonso

#### Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:  
Describe matter properties. To understand and solve Chemistry problems. To know how to handle laboratory materials and apply techniques correctly. To know the laboratory personal safety procedures.

#### Prerequisites

Before the course unit the learner is expected to be able to:  
To have sufficient basic knowledge of chemistry to follow the program.

#### Course contents

General Chemistry

#### Course contents (extended version)

1. The matter.
  - Classification of matter. Pure substances and mixtures. Suspensions and colloidal solutions.
  - States of matter.
  - International system of units.
  - Intermolecular forces.
  - Boyle's Law, Charles's Law and Gay Lussac's Law.
2. Atoms, Molecules and Ions.
  - Atomic number, mass number and isotopes.
  - The periodic table.
  - Molecules and ions. Nomenclature of compounds.
3. Chemical Kinetics.
  - The effect of concentration, pressure and temperature on reaction rate.
  - Stoichiometry and reaction rate.
  - 1st order reactions.
  - Collision theory. Catalysis.
4. Chemical Reactions.
  - Concept of mole. Avogadro's number.
  - Molar mass.
  - Stoichiometry. Lavoisier's Law.
  - Balancing of chemical equations.
  - Limiting reagent.
  - Reaction Yied.
  - Concentrations of solutions. Dilutions.
5. Chemical Equilibrium.
  - The concept of equilibrium and the equilibrium constant.
  - Equilibrium constant expressions.
  - Factors that affect the chemical equilibrium. Le Châtelier's Principle.
6. Acid-Base Equilibrium
  - Acids and bases according to Arrhenius, Bronsted-Lowry and Lewis.
  - pH. Sorensen's scale.
  - Acid-base properties of water. The ion product of water.
  - Weak acids, weak bases and their ionization constants. Conjugated acids and bases.
  - Diprotic and polyprotic acids.
  - Ionization. Percentage Ionization.
  - Buffer solutions.
  - Acid-base titrations. Acid-base titrations curves.
  - Acid-base indicators.
7. Solubility.
  - Solubility and dissolution temperature.
  - Solubility product.
  - Precipitation.
  - Effect of pH on solubility.
  - The common ion effect.
8. Redox Equilibrium.
  - Electrochemistry. Redox reactions.
  - Electrochemical cells. Standard Reduction Potentials. The Nernst equation.
  - The potential or electromotive force of a battery.
  - Batteries.
9. Organic Chemistry.
  - Hydrocarbons.
  - Functional groups: Alcohols, Esters, Aldehydes, Ketones, Carboxylic acids, Amines.

#### Recommended reading

1. Chang, R, Goldsby, K, Química - 11ª Edição, Ed. McGraw Hill, 2002;
2. Goldberg, D, Fundamentals of Chemistry, Ed. McGraw-Hill, 2006;
3. Murray, J, Fay, R, Chemistry, Ed. Prentice Hall, 2003;
4. Zumdahl, S. S, Zumdahl, SA, Chemistry, Ed. Houghton Mifflin Company, 2007;
5. Solomons, T. W. G, Química Orgânica, Ed. LTC - Livros Técnicos e Científicos Editora Lda, 2012;

### Teaching and learning methods

Theoretical lessons: Presentation of theoretical concepts. Presentation, analysis and discussion of application examples. Practical lessons: Resolution of exercises and explanation of doubts related with exercises proposed. Laboratory work.

### Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final)
  - Intermediate Written Test - 25% (Assessment of theoretical (75%) and practical (25%) knowledge acquired.)
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  - Intermediate Written Test - 25% (Assessment of theoretical (75%) and practical (25%) knowledge acquired.)
  - Laboratory Work - 25% (Quizzes about laboratory work.)
2. Alternative 2 - (Regular, Student Worker) (Final)
  - Final Written Exam - 75% (Assessment of theoretical (75%) and practical (25%) knowledge acquired.)
  - Laboratory Work - 25% (Preparation of a written report on a practical activity carried out in laboratory classes.)
3. Alternative 3 - (Regular, Student Worker) (Supplementary, Special)
  - Final Written Exam - 100% (Exam with questions from the theoretical component (50%) and the practical component (50%).)

### Language of instruction

1. Portuguese
2. Spanish
3. English

### Electronic validation

Maria João de Almeida Pinto Santos Afonso	Luís Avelino Guimarães Dias	Artur Jorge de Jesus Gonçalves	Maria Sameiro Ferreira Patrício
06-02-2024	08-02-2024	09-04-2024	09-04-2024