INSTITUTO POLITÉCNICO DE BRAGANÇA

Course Unit	General Chemistry II			Field of study	Chemistry		
Bachelor in	Chemical Engineering			School	School of Technology and Management		
Academic Year	2023/2024	Year of study	1	Level	1-1	ECTS credits	6.0
Type	Semestral	Semester	2	Code	9125-755-1204-00-23		

Workload (hours)	162	Contact hours	T -	TP 20	PL 40	TC -	S -	E -	OT -	O -

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): Ana Maria Alves Queiroz da Silva

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. Develop competences in basic laboratorial safety, health and ambiental protection.
2. Know and manipulate material used on the most common techiques and unit operations on the analytical laboratory: measurements of masses, measurements of volumes, heating, cooling, and filtration.
3. Learn how to aquire and manipulate experimental data obtained on chemical measurements using statistical methods.
4. Understand numeric determinations necessary to prepare standard solutions using different concentration units.
5. Know and manipulate different techiques and several unit operations to prepare and purify organic and inorganic compounds.
6. Describe and perform volumetric analysis based on the major chemical equilibriums (acid-base, solubility, complexation and oxidation-redution).

Prerequisites

Before the course unit the learner is expected to be able to:
Having fundamental concepts of Chemistry.

Course contents

Fundamentals. Basic Safety Aspects on a Chemical Laboratory. Material and Equipment. Experimental Data Treatment. Standard Solutions Preparation and Experimental Determination of Physico-Chemical Properties. Unit Operations. Volumetric Analysis.

Course contents (extended version)

1. Safety on a Chemical Laboratory
   - Some general safety rules.
   - The risk and danger concepts.
   - Chemical residues.
   - Fires.
   - Inflammable solvents.
   - Accidents.
2. Material and equipment in a chemical laboratory
   - General description of a laboratory.
   - Materials used on the laboratory equipment.
   - Measurement of a liquid volume.
   - Cleaning glass material.
   - Measurement of a solid mass.
   - Heating equipment.
   - Filtration apparatus.
   - Equipment associated with mass measurements.
   - Types of water in the laboratory.
   - Reagents, primary standards and standard solutions.
3. Experimental Data Treatment
   - Types of errors on experimental data.
   - Manipulation of errors.
   - Basic statistical definitions.
4. Standard Solutions and Physico-Chemical Properties
   - Density and specific gravity.
   - Concentration units. Equivalent-gram concept.
   - Melting point of a solid.
   - Boiling point of a liquid.
5. Unit Operations
   - Unit operations.
   - Flow-sheets.
   - Precipitation.
   - Crystalization.
   - Distillation.
   - Unit process.
6. Volumetric Analysis
   - Fundamentals.
   - Common material for titrimetric analysis.
   - Classification of volumetric analysis methods.
   - Normallity of a solution.
   - Quantitative analysis on acid-basic volumetry.
   - Quantitative analysis on precipitation volumetry.
   - Quantitative analysis on complexiommetric volumetry using E. D. T. A.
   - Quantitative analysis on redox volumetry.
7. Laboratory works
   - Preparation of solutions and determination of densities.
   - Preparation of an aqueous solution of hydrochloric acid and its standardization with borax.
   - Preparation of an aqueous solution of sodium hydroxide and its standardization with HCl.
   - Determination of the acidity of commercial vinegar.
   - Determination of chlorides by the Mohr method.
   - Determination of the total hardness of tap water.
   - Determination of the concentration of commercial oxygenated water.

Recommended reading

1. R. Chang, Química, 13ª Edição, McGraw-Hill, 2020.
2. J. A. Dean, Analytical Chemistry Handbook, 2nd Edition, McGraw Hill, 2004.
3. D. A. Skoog, Analytical Chemistry, 7th Edition, Saunder College Publishing, 2000
4. J. A. Beran, Laboratory Manual for Principles of General Chemistry, 8th Edition, Wiley & Sons, 2008.
5. D. A. Skoog, Fundamentals of Analytical Chemistry, 8th Edition, Thomson, 2004.

Teaching and learning methods

Classes are divided into theoretical and practical - laboratory. Theoretical classes: presentation, analysis and discussion of application examples of theoretical concepts. Laboratory classes: performance of 7 experimental works and working reports. Non-presence period: study of theoretical concepts, resolution of proposed exercises and preparation of laboratory work.

Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final)
   - Laboratory Work - 30% (Individual practice and preparation of laboratory works. Mandatory at least 70% of laboratory works)
   - Case Studies - 25% (Exercises resolution and discussion)
   - Final Written Exam - 45% (Minimum classification of 6/20)
2. Alternative 2 - (Regular, Student Worker) (Supplementary, Special)
   - Final Written Exam - 70% (Only for students with at least 4 practices completed)
   - Laboratory Work - 30% (Individual practice and preparation of laboratory works)

Language of instruction

English

Electronic validation

Ana Maria Alves Queiroz da Silva	Hélder Teixeira Gomes	António Manuel Esteves Ribeiro	José Carlos Rufino Amaro
29-02-2024	13-03-2024	13-03-2024	16-03-2024