UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Introduction To Elementary Laboratory Operations

2627-1-ESM02Q023-ESM02Q02302

Aims

General objectives. The course allows students to gain familiarity with laboratory techniques and apparatus, and to apply their knowledge of concepts from General Chemistry course in an actual laboratory situation. The course will also give the basic principles and procedures of laboratory safety.

Knowledge and understanding. Students, by the end of the course, will learn the basic principles of both stoichiometry and chemical reactions of inorganic compounds. Moreover, students will learn to know and exploit general chemistry lab equipment and glassware as well as the basic safety rules.

Applying knowledge and understanding. By the end of the course, students will be able to (i) solve simple problems of stoichiometry, and (ii) perform simple chemistry lab experiments.

Making judgments. By the end of the course, students will become able to (i) choose the methodology to study the chemistry of a selected system, and (ii) individuate proper compounds and techniques to carry out simple chemical reactions.

Communication skills. By the end of the course, students will be able to describe the arguments of the course and to participate in stimulating discussions.

Learning skills. By the end of the course, students will have developed the ability to solve and face with more complex exercises, arguments and experiments.

Contents

The course is organized into a *Theoretical Part* that includes a review of the fundamental concepts of general chemistry applied to the stoichiometry, stoichiometry exercises, and the explanation of the theory necessary for a complete understanding of the *Experiments* that will be conducted in the laboratory. The student's preparation will

be completed by the parallel execution of practical Experiences aimed at teaching the main laboratory techniques, which will be carried out by the students individually or in groups.

Detailed program

Theoretical Part
Stoichiometry: Elements, atoms, ions, atomic mass, Periodic system, oxidation number. Molecules, Molecular Mass, Moles, Empirical Formulas and Molecular Formulas, Percent composition of compounds. Balance of chemical equations. Concentration of a solution, Mixing and dilution, Volumetric Analysis, Equilibrium and equilibrium constant. Dissociation and formation equilibria. Colligative properties. Acid and bases, Ionic product of water, pH and pOH, strong and weak acid and bases. pH of the saline solutions. Buffer solutions. Solubility and solubility equilibria, solubility and pH.

Laboratory
Laboratory experiments: Limiting agent, Synthesis and reactivity of inorganic compounds (perborate, alum), redox reactions (copper cycle), solubility , introduction to volumetric analysis (acid-base titrations), precipitation / separation and identification of cations (qualitative analysis), synthesis of materials applicable to electronic devices.

Prerequisites

Algebraic calculations, knowledge of logarithmic and exponential functions, SI units, numbers in decimal and scientific notation, are required. All students must complete mandatory safety training to participate in the laboratory course.

Teaching form

18 two-hours lectures, in person, Delivered Didactics (3 ECTS)
9 four-hours lab activities, in person, Interactive Teaching (3 ECTS)
The attendance of the Laboratory experiences is compulsory for the 80% of the experiences.
Students lab will start in November 2026.

Textbook and teaching resource

Materials to be downloaded from e-learning.
Useful text book: P. Michelin Lausarot, G.A. Vaglio, *Stechiometria per la chimica generale*, Piccin.

Semester

First semester.

Assessment method

The evaluation of the 3 ECTS related to the in-class exercises is assessed by written exams constituted of exercises connected to the topics of the lessons. This will help to assess the effective learning by the students of the main principles of chemical stoichiometry. The final grade of the exam is expressed in thirtieths with possible honors.
The written exam will be constituted by two in-course assessments or, alternatively, a full test.
In the case of the two written in-course assessments, these will consist exclusively of 4 exercises and will have a maximum duration of 1h30min each. The first in-course assessment will cover the first part of the program, whereas the second in-course assessment will cover the second part of the program.
In the case of the full test, this will consist of 6 exercises covering the entire program taught in class and will have a maximum duration of 2h30min.
The assessment, regarding the 3 ECTS of Lab activity, is composed by the following aspects: the attendance to the Lab (at least 7/9 of the experiments), and ***the evaluation of the reports and of the topics related to the lab experiences (with a score ranging from 0 to 2).*** This will help to assess the effective learning by the students of the main principles of the chemical reactivity of inorganic compounds.
Therefore, ***the overall assessment of the module "Introduction to Elementary Laboratory Operations" will be the sum of the evaluation of the stoichiometry written test and the lab grade.***

Finally, the overall grade for the module "*Introduction to Elementary Laboratory Operations*" will contribute in a weighted manner (6 ECTS) to determine the final grade of the exam "*Introduction to Elmentary Laboratory Operations - Elements of Experimental Method*" (12 ECTS).

Office hours

From Monday to Friday by appointment.

Sustainable Development Goals

QUALITY EDUCATION | RESPONSIBLE CONSUMPTION AND PRODUCTION