

General info

COURSE TITLE	ELEMENTS OF CHEMISTRY (6 CFU-60 hours) – <u>Optional exam</u> First-year Bachelor Program – First Semester Academic Year 2023/2024
TEACHER	MARTINA BORTOLAMI Ph.D. PostDoc at the Department of Basic and Applied Sciences for Engineering (SBAI), Sapienza University of Rome, via Castro Laurenziano, 7, 00161 Rome e-mail: martina.bortolami@uniroma1.it
OFFICE HOURS FOR STUDENTS	Online: on request by e-mail

Objectives

COURSE DESCRIPTION	The course aims to provide students with knowledge of general concepts of inorganic chemistry.
LEARNING OBJECTIVES	Upon completion of the course, the students will be able to understand and describe the general concepts of inorganic chemistry treated during the lessons and to solve simple exercises that demonstrate their real understanding of the treated topics.
TEACHING TOOLS	A virtual classroom (entitled Elements of Chemistry 2023-2024) will be used as a repository of all necessary materials and to manage the weekly assignments. To join the virtual classroom, please, send a request via email to the teacher. A Gmail or an institutional account is needed. To attend online lessons and to have access to all the material published in the virtual classroom, the student must sign and send to the teacher the <i>"Commitment not to disseminate teaching material and confidentiality clause"</i> document, which can be found in the virtual classroom.

Lectures

PERIOD	From October 3 rd to December 19 th
TIME	Tuesday 2:00 – 7:00 pm Italian time
LOCATION	Online; zoom link: https://uniroma1.zoom.us/j/6662317600
ATTENDANCE	Though not mandatory, attendance is taken, expected and strongly recommended.
PROGRAM	<p>Introduction to chemistry. States of matter and matter composition. Law of conservation of mass, law of definite proportions, law of multiple proportions. Evolution of the atomic model. Quantum numbers and orbitals. Electron configuration. Pauli exclusion principle. Hund's rule. Aufbau.</p> <p>Atomic number, mass number, isotopes, isobars, isotones. Atomic mass, average atomic mass, relative atomic mass (atomic weight), molecular weight.</p> <p>Periodic table: groups, periods, block. Valence and core electrons. The octet rule. Ions and ions configuration. Paramagnetic and diamagnetic atoms and ions. Periodic properties: radius and atomic volume, electron affinity, electronegativity, ionization energy.</p> <p>Chemical bonds: ionic bond, covalent bond, metallic bond. Intermolecular forces: Van der Waals forces, hydrogen bonding.</p> <p>Mole and molar mass. Chemical Formulas. Valence. Lewis structures. Compounds and nomenclature.</p> <p>Intoduction to chemical Reactions. Gases. Pressure and pressure units. Boyle's law. Charles's law. Avogadro's law. The ideal gas law. Mixtures of gases and partial pressures.</p> <p>Aqueous solutions. Strong and weak electrolytes. Dissociation/ionization. Concentrations: molarity, molality, percent by mass, percent by volume, mole fraction, parts per million, parts per billion. Equivalent, equivalent weight, normality. Principle of electroneutrality. Solution dilution.</p> <p>Surface tension, viscosity, capillary action. Changes between states of matter. Heating curve for water. Phase diagrams for water and other substances.</p> <p>Colligative Properties: vapor pressure lowering, freezing point depression, boiling point elevation, and osmotic pressure.</p> <p>Redox reactions. Balancing redox reactions.</p>

Principles of Chemical Equilibrium.
Solubility and solubility product.

Acids and bases, pH and pOH scale. pH of strong and weak acids and bases.
Salts Hydrolysis. Buffer solution.

TEXTBOOKS

Lecture notes. Lesson slideshows and exercises will be provided by the teacher.

In addition:

B.A. Averill, P. Eldredge, Principal of general chemistry, pdf free download - Or
any other similar book

Tentative schedule

Week 1	LECTURE 1	Presentation of the course (program, texts, calendar, and methods of evaluation). Introduction to chemistry. States of matter and matter composition. Law of conservation of mass, law of definite proportions, law of multiple proportions. Evolution of the atomic model. Quantum numbers and orbitals.
Week 2	LECTURE 2	Electron configuration. Pauli exclusion principle. Hund's rule. Aufbau. Atomic number, mass number, isotopes, isobars, isotones. Atomic mass, average atomic mass, relative atomic mass (atomic weight), molecular weight.
Week 3	LECTURE 3	Periodic table: groups, periods, block. Valence and core electrons. The octet rule. Ions and ions configuration. Paramagnetic and diamagnetic atoms and ions. Periodic properties: radius and atomic volume, electron affinity, electronegativity, ionization energy.
Week 4	LECTURE 4	Chemical bonds: ionic bond, covalent bond, metallic bond. Intermolecular forces: Van der Waals forces, hydrogen bonding. Mole and molar mass. Chemical Formulas. Valence. Lewis structures.
Week 5	LECTURE 5	Compounds and nomenclature.
Week 6	LECTURE 6	Introduction to chemical Reactions. Gases. Pressure and pressure units. Boyle's law. Charles's law. Avogadro's law. The ideal gas law. Mixtures of gases and partial pressures.
Week 7	LECTURE 7	Aqueous solutions. Strong and weak electrolytes. Dissociation/ionization. Concentrations: molarity, molality, percent by mass, percent by volume, mole fraction, parts per million, parts per billion. Equivalent, equivalent weight, normality. Principle of electroneutrality. Solution dilution.
Week 8	LECTURE 8	Surface tension, viscosity, capillary action. Changes between states of matter. Heating curve for water. Phase diagrams for water and other substances.

Colligative Properties: vapor pressure lowering, freezing point depression, boiling point elevation, and osmotic pressure.

Week 9 LECTURE 9 Redox reactions. Balancing redox reactions.

Week 10 LECTURE 10 Principles of Chemical Equilibrium.
Solubility and solubility product.

Week 11 LECTURE 11 Acids and bases, pH and pOH scale.
pH of strong acids and bases.
pH of weak acids and bases.

Week 12 LECTURE 12 Salts Hydrolysis.
Buffer solution.

Exams and grading

CLASSROOM EXERCITATIONS

Classroom exercitations will be taken during the course, every week, on virtual classroom.

Each exercitation will be related to the topics covered in the week before the test. Each exercitation will include a questionnaire consisting of multiple choice questions and eventually exercises (based on the topics treated).

EXAM

The exam will be done after the end of the course, in the dates reported below. The complete exam will be related to all the topics covered during the course. The exam will include a questionnaire, consisting of multiple choice questions, and exercises.

The final mark is expressed in thirtieth /30.

EXAM DATES AY 2023/24

January 12th, February 9th, June 7th, July 12th, September 13th
Extraoridinary exam date April 12th

Useful tips to succeed

1. Study every day
2. Plan your time
3. Attend regularly
4. Create connections with the academic community
5. Be informed
6. Be involved
7. Study with other colleagues
8. Respect people
9. Ask for help