

Chemistry I

Calendar: 1st semester

Contact Hours: 30h00 T + 37h50 TP + 15h OT

Scientific Area: Química

Learning outcomes of the curricular unit

This curricular unit constitutes an introductory tool for an adequate formation in the chemical field, required of any chemical engineer. It is intended that the student acquires the knowledge and understanding of the fundamentals of atomic structure and properties and of chemical bonds, which are the basic foundations of chemistry, with the aim of understanding the structure of matter and its transformations.

It is further intended that the student understands and is proficient with basic chemistry skills and is able to apply them to simple chemical calculations, such as concentration and measurable units calculations for pure substances and solutions, as well as stoichiometry and chemical equations.

Even though the essentially introductory character of this Curricular Unit, some concepts are startups that will be further developed in more advanced units.

Syllabus

1 - Introduction to Chemistry: Constitution of the atom. Isotopes. Nomenclature of inorganic compounds. Measurement units and concentration calculations. Chemical equations. Stoichiometry of reactions.

2 - Atomic structure. Evolution of atomic models. Bohr model. Wave-particle duality. Principles of Quantum chemistry. Atomic orbitals. Electronic configuration;

3 - Periodic table and periodic properties;

4 - Chemical bond in molecules. Octet rule and Lewis structures. Molecular geometries by the VSEPR and the Valencia Bond Theory. Covalent radii. Expanded octet. Molecular Orbital Theory;

5 - Intermolecular forces. Van der Waals interactions (Keesom, Debye and London) and interactions by hydrogen bonds;

6 - Chemical bonds on ionic compounds, in solid metals, on covalent solids, on coordination compounds. Structure, energetics and theories of the bond connection.

Demonstration of the syllabus coherence with the curricular unit's objectives

To achieve the objectives of this curricular unit, the student will learn the evolution of the concept of atom and molecules. Since this curricular unit is considered a initiation in chemistry, the basic concepts of chemistry and of chemical calculations will be reminded, since they are essential tools in following curricular units. The syllabus further confers the student with the skills and knowledge to distinguish the different groups of elements and periodic properties, to interpret the geometries adopted by molecules in the light of different models. The student will be able to understand the concept of intermolecular and intramolecular bonding and the influence of the different intermolecular forces in the physical state and in the properties of matter. Finally, the student will be given the knowledge to understand the effect of different types of chemical bonds in the different properties of solids.

Teaching methodologies (including evaluation):

The curricular unit comprehends theoretical and practical classes. The theoretical contents will be presented to the students by means of informatic support – power point slides, that will be made available to the students in the Moodle platform. In practical classes series of exercises concerning the theory will be solved in class, by the teacher and students.

The evaluation in the regime of continuous evaluation will be made by 3 tests (75 % overall) + non announced small exercises, relating to fundamental chemical calculations (25 % overall). In the regime of evaluation by exam two situations are admissible a final exam (75 %) and the small exercises (25 %) or 100 % exam.

Demonstration of the coherence between the teaching methodologies and the learning outcomes.

The main goal of this curricular unit is to allow the student to acquire basic knowledge and understanding about the fundamentals of chemistry, in order to acquire a solid base formation crucial for any chemical engineer.

The curricular unit is organized into theoretical and practical classes. The theoretical contents will be exposed in the theoretical classes to allow a solid and consistent teaching.

The acquired knowledge will be consolidated by solving practical problems focusing on the syllabus contents. Solving the problems is done by the teacher, as exemplification and by the students for practice, during the practical classes.

To ensure that the basic concepts of chemical calculations (measurement units, concentration, stoichiometry of chemical reactions) is solidly known and consolidated, small exercises will be solved during all the duration of the semester, some of which allowing to evaluate the student's level of learning and skills.