

Academic Year: ( 2018 / 2019 )

Review date: 15-06-2018

Department assigned to the subject:

Coordinating teacher: SAN MIGUEL ARNANZ, VERONICA

Type: Compulsory ECTS Credits : 3.0

Year : 1 Semester : 2

**REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)**

To study Chemistry before High School

**OBJECTIVES**

The aim of this course is that students learn the fundamental principles of chemistry that explain the basic structure of matter and that allow us to understand the chemical changes that occur therein. At the end of this course, general capabilities that the student should have acquired are:

- Knowledge and understanding of the essential facts, concepts, principles, and theories related to the area of chemistry
- Knowledge of chemical terminology and the main elements and organic and inorganic compounds.
- Skill to evaluate, interpret, and synthesize data, and chemical information.
- Ability to apply a multidisciplinary knowledge that enables to solve a complex problem.

The course will allow the students to acquire a knowledge which will make possible to continue their studies in the Chemical Basis of Engineering course and to develop solutions for specific applications.

**DESCRIPTION OF CONTENTS: PROGRAMME****MODULE 1****1.1. STRUCTURE OF MATTER**

- ¿ Atomic structure. Atomic magnitudes: atomic and mass number.
- ¿ Electronic structure. Electronic distribution in energy levels: quantum numbers. Electronic configurations.
- ¿ Organization of the elements in the periodic table. Periodic properties.

**1.2. CHEMICAL BONDING**

- ¿ Definition of ionic, covalent, and metallic bonding.
- ¿ Lewis structures.
- ¿ Molecular geometry: Valence-shell electron-pair repulsion theory. Polarity of the molecules.
- ¿ Valence bond theory. Hybridization of atomic orbitals (sp, sp<sup>2</sup>, sp<sup>3</sup>).

**MODULE 2****2.1. INORGANIC FORMULATION**

- ¿ Nomenclature of inorganic compounds.
- ¿ Examples of the most common inorganic compounds.

**2.2. ORGANIC FORMULATION**

- ¿ Classification of the main organic functional groups.
- ¿ Nomenclature of organic compounds.
- ¿ Examples of the most common organic compounds.

**MODULE 3****3.1. BASIC CONCEPTS**

- ¿ Mole Concept. Relationship between mass, mole, number of atoms, molecules, and ions.

**3.2. MIXTURES AND SOLUTIONS**

- ¿ Ways of expressing the concentration of a solution.
- ¿ Preparation of a solution.

**3.3. CHEMICAL REACTIONS**

- ¿ Chemical equations. Balancing chemical equations. Stoichiometric calculations: reactants, products, weight, and yields.
- ¿ Limitant reactant in a chemical reaction.

**MODULE 4****4.1. THERMOCHEMISTRY**

¿ Definition and relationship between the state functions; enthalpy (H), entropy (S), and Gibbs free energy (G).

¿ Enthalpies of formation, reaction and bond. Hess's law.

#### 4.2. CHEMICAL EQUILIBRIA

¿ Characteristics of reversible chemical processes. Equilibrium concept and equilibrium constant (K). Determination of the different equilibrium constant expressions ( $K_c$  y  $K_p$ ) for homogeneous and heterogeneous equilibria.

¿ Determination of the relationship between equilibrium constants and thermodynamic parameters.

#### MODULE 5

ACID-BASE EQUILIBRIA. Transfer of protons.

¿ Definition of acids and bases. Description of dissociation reaction of strong and weak acids and bases. Acid-base titration.

¿ Determination of acid and base ionization constants ( $K_a$  and  $K_b$ ). Determination of pH.

¿ Buffer solutions. Henderson-Hasselbach equation.

#### MODULE 6

ELECTROCHEMISTRY. Transfer of electrons.

¿ Oxidation-reduction concept.

¿ Balancing redox reactions by ion-electron method in acidic and basic media.

¿ Structure and operation of galvanic cells. Identification of the anode and cathode in a cell.

Standard reduction potential.

#### LEARNING ACTIVITIES AND METHODOLOGY

Lectures, collective tutorials, individual tutorials and homework; oriented to attainment of theoretical knowledge.

Problem solving lectures in class and homework; oriented to attainment of practical knowledge and skills related with the syllabus.

#### ASSESSMENT SYSTEM

Continuous assesment:

50% Quizzes

Final exam: 50% global mark. It is necessary to obtain 4 as a minimum grade in the final exam to average with continuous assesment.

#### BASIC BIBLIOGRAPHY

- P. Atkins, L. Jones, L. Laverman Chemical Principles. The Quest for Insight, Macmillan, Sixth edition.

- R. Chang Chemistry, McGrawHill, Ninth edition.

- R. H. Petrucci, W. S. Harwood, F. G. Herring, J. Madura General Chemistry. Principles and Modern Applications, Prentice Hall, Ninth edition.