27100 - General Chemistry

Información del Plan Docente

Academic Year	2016/17
Academic center	100 - Facultad de Ciencias
Degree	446 - Degree in Biotechnology
ECTS	12.0
Course	1
Period	Annual
Subject Type	Basic Education
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

5.Activities and resources

5.1.General methodological presentation

The learning process that is designed for this subject is based on the following: Theory 7 ECTS Numerical problems 3 ECTS Laboratory sessions 2 ECTS Students enrolled in the course can log in to contents and materials in the Moodle page for the course.

5.2.Learning activities

The available program that will assist the student to achieve the expected results involves the following activities...

1: Theory classes as participative and interactive lectures. **2:** Participative problem-solving sessions in groups with half of the students. **3:** Laboratory sessions in reduced groups. **4** : Personalized tutorials. **5** : Support academic training through

the resources available in the moodle page of the course where the students can consult the following material. - Copy of the slides used in the lectures by the teacher, structured by topics. - Notebook of problems, structured by topics. - Notebook of nomenclature of inorganic compounds with examples - Notebook of nomenclature of organic compounds with examples - Selected didactical videos.

5.3.Program

GENERAL CHEMISTRY

1. INTRODUCTION TO THE MODERN CHEMISTRY.

The Scope of Chemistry. Properties, States and Classification of matter. Measure of Properties of the Matter. SI Units. Significant Figures. Uncertainties in Scientific Measurements.

2. ATOMS AND THE ATOMIC THEORY.

Early Chemical Discoveries. Electron and other Discoveries: X-ray and Radioactivity. The Nuclear Atom. Chemical Elements. Determination of Atomic Mass. The Concept of the Mole and Molar Mass.

3. CHEMICAL COMPOUNDS.

Types of Compounds and their Formulas. Structural Representation of Molecules. The Concept of the Mole and Chemical Compounds. Composition of Chemical Compounds. Oxidation States.

4. CHEMICAL REACTIONS AND STOICHIOMETRY.

Chemical Reactions and the Chemical Equation. The Chemical Equation and the Stoichiometry. Chemical Reactions in Solutions. The Nature of Aqueus Solutions. Practical Aspects of the Stoichiometry.

5. CHEMICAL THERMODYNAMIC.

Some Terminology. Heat. Work. The first Law of Thermodynamics. Heats of Reaction: DU and DH. Relationships involving DH. Standard Enthalpies of Formation. Sources and Uses of Energy. Spontaneity: the Meaning of Spontaneous Change. Spontaneity and Disorder: the Concept of Entropy. Criteria for Spontaneous Change: the Second Law of Thermodynamics. Evaluating Entropy and Entropy Changes. Standard Free Energy Change, DGº. Free Energy Change and Equilibrium.

6. CHEMICAL KINETICS.

The Rate of a Chemical Reaction. Measuring Reaction Rates: Concentrations as a Function of Time. Effect of Concentrations on Rates of Reactions: the Rate Law. Zero-order Reactions. First-order Reactions. Second-order Reactions. Reactions Kinetics: a Summary. Theories of Chemical Kinetics. Effect of Temperature on Reaction Rates. Reaction Mechanisms. Catalysis.

7. ELECTRONS IN ATOMS.

27100 - General Chemistry

Electromagnetic Radiation. Atomic Spectra. Quantum Theory: the Photoelectric Effect. The Bohr Atom: Ionization Energy of Hydrogen Atom. Wave-particle Duality. The Uncertainty Principle. Wave Mechanics. Quantum Numbers and Electron orbitals. Electron Spin: A Fourth Quantum Number. Multielectron Atoms. Nuclear Charge Effect. Shielding Effect. Orbital Energy Diagrams. Electron Configurations of the Elements and the Periodic Table.

8. THE PERIODIC TABLE AND ATOMIC PROPERTIES.

Classifying the elements: the Periodic Law and the Periodic Table. A Modern Periodic Table: the Long Form. Metals and non-metals, Electron configurations of ions. Atomic Radius. Ionization Energy. Electron Affinity. Magnetic Properties. Atomic Properties and the Periodic Table: a Summary.

9. CHEMICAL BONDING I. BASIC CONCEPTS.

Experimental Aspects of Chemical bonding. Lewis Theory: an Overview. Ionic Bonding: an Introduction. Crystal Structures. Ionic Crystal Structures. Energetics of Ionic Bond Formation. Covalent Bonding: an Introduction. Partial Ionic Character of Covalent Bonds. Electronegativity. Oxidation States. Partial Covalent Character of Ionic Bonds. Polarization. Covalent Lewis Structures. Resonance. Exceptions to the Octet Rule. Molecular Shapes. Valence Shell Electron Pair Repulsion (VSEPR) Theory. Bond Lengths and Bond Energies.

10. CHEMICAL BONDING II. ADDITIONAL ASPECTS.

An Introduction to Valence Bond Theory. Hybridization of Atomic Orbitals. Multiple Covalent Bonds. An Introduction to Molecular Orbital Theory. Molecular Orbitals in Homonuclear Diatomic Molecules of the Second Period Elements. Delocalized Molecular Orbitals. Bonding in the Benzene Molecule. The Metallic bond. Structure of the Metals. Bonding in Metals: Band Theory.

11. SOLIDS. INTERMOLECULAR FORCES. RELATIONSHIPS INVOLVING ATOMIC COMPOSITION-BONDING-STRUCTURE-PROPERTIES.

Comparison of the States of Matter. Types of Solids. Covalent Solids. Intermolecular Forces. Van der Waals Forces. Hydrogen Bonds. Relationships Between Atomic Composition and Chemical Bonding. Relationships Involving Atomic Composition-Chemical Bonding-Structure-Properties. Study of Some Properties: Melting and Boiling Points; Mechanic Properties; Solubility.

12. GASES.

Properties of a Gas: the Concept of Pressure. The Simple Gas Laws. The Ideal Gas Equation: Applications. Mixtures of Gases. Nonideal (real) gases.

13. LIQUIDS.

Properties of Liquids. Vaporization and Vapor Pressure. Transitions Involving Solids. Phase Diagrams. Water Properties.

14. SOLUTIONS.

27100 - General Chemistry

Type of Solutions: Some Terminology. Energetic of the Solution Process. Solution Concentration. Solution Formation and Equilibrium. Mixtures of liquids: ideal solutions and their Vapor Pressures. Liquid-vapor Equilibrium: Ideal Solutions. Solutions of Solids and Gases in Liquids: Ideal Dilute solution. Vapor Pressure of Ideal Dilute Solutions. Solubilities of Gases. Solutions of Solids in Liquids: Colligative Properties. Colloidal Mixtures.

15. PRINCIPLES OF CHEMICAL EQUILIBRIUM.

The Equilibrium Constant Expression. Relationships Involving Equilibrium Constants. The Magnitude of an Equilibrium Constant. The Reaction Quotient, Q: Predicting The Direction of Net Change. Altering Equilibrium Conditions: Le Châtelier's Principle.

16. ACID-BASE EQUILIBRIA.

Arrhenius Theory: A Brief Review. Brønsted-Lowry Theory of Acids and Bases. Lewis Acids and Bases. Self-Ionization of Water and the pH Scale. Strong Acids and Strong Bases. Weak Acids and Weak Bases. Polyprotic Acids. Molecular Structure and Acid-Base Behavior. Acid-Base Behavior of Organic Compounds. Acid-Base Equilibrium Calculations. Buffer Solutions

17. SOLUBILITY AND COMPLEX-ION EQUILIBRIA.

Equilibria Involving Complex Ions. Complex-Ion Equilibrium Calculations. Solubility Product Constant, Ksp. Relationship Between Solubility and Ksp. Common-Ion Effect in Solubility Equilibria. Limitations of the Ksp Concept. Criteria for Precipitation and its Completeness. Precipitation Equilibrium calculations.

18. REDOX EQUILIBRIUM AND ELECTROCHEMISTRY.

Redox Equilibrium. Nerst Equation. Redox Equilibrium Calculations. Electrode Potentials and their Measurement. Standard Electrode Potentials. E cell , ΔG, and K. E cell as a Function of Concentrations. Batteries: Producing Electricity Through Chemical Reactions. Corrosion: Unwanted Voltaic Cells. Electrolysis: Causing Nonspontaneous Reactions to Occur. Industrial Electrolysis Processes

19. PHYSICAL AND CHEMICAL PROPERTIES OF THE ELEMENTS.

Elements: Classification of Metals, Non-metals and Semimetals. Structure: Polymorphs and Allotropes; Physical Properties. Chemical Properties: Standard Reduction Potentials, Oxidation States.

20. OBTAINING THE ELEMENTS.

Metallic Elements: Natural State. Obtaining Metals, Metal Oxides Reduction (Ellingham Diagram), Carbon Reduction; Metalotermias; Electrolysis. Nonmetals: Natural State and Preparation of some Representative Elements.

21. STRUCTURE OF ORGANIC COMPOUNDS

Organic Compounds and Structures: An Overview. Alkanes. Cycloalkanes. Stereoisomerism in Organic Compounds. Isomerism cis/trans. Optic isomerism.

27100 - General Chemistry

LABORATORY PRACTICE PROGRAM

- Security and basic laboratory work
- Concentration of solutions. Strong and weak electrolites.
- Equilibria in solution. Indicators. Acid-base reactions.
- Determining an equilibrium constant.
- Column chromatography. Separation of a mixture of dyes.
- Liquid-liquid extraction. Isolation of caffeine.

5.4.Planning and scheduling

Schedule sessions and presentation of works

Schedules of lectures and problems will coincide with the officially established and will be available at: https://ciencias.unizar.es/grado-en-biotecnologia.

The places, calendar and groups for training and practical sessions will be established in coordination with the rest of maters at beginning of course. The Coordinator will produce the groups of students for these activities at beginning of course to avoid overlaps with other subjects.

5.5.Bibliography and recomended resources