26407 - Chemistry

Información del Plan Docente

Academic Year	2016/17
Academic center	100 - Facultad de Ciencias
Degree	296 - Degree in Geology
ECTS	6.0
Course	1
Period	First semester
Subject Type	Basic Education
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

For students enrolled in the subject, classrooms and laboratories, the datesheet of lectures and practical sessions will be published online via Bulletin Board advertisements on the platform Moodle at the University of Zaragoza, https://moodle2.unizar.es/add/ . Students will be distributed in groups for the laboratory sessions, which will be also published in Moodle, organized by the Coordinator of the Degree. Examination dateseet will be available at the Faculty of Science website https://ciencias.unizar.es/grado-en-geologia-0 .

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:

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Activity 1: Learning the basics of chemistry (4,0 ECTS)

Metodology: Interactive lectures (4,0 ECTS)

Skills acquired by the student:

- Understanding and use of the basic theoretical aspects of chemistry.

- Acquiring specific language of different topics in chemistry.

- Transmission of knowledge using specific vocabulary.

- Being able to use the acquired knowledge in other subjects in the context of Geology studies.

Evaluation: Written test on the basics of chemistry.

Activity 2: Work in the laboratory (0,6 ECTS)

Metodology: laboratory sessions (0,6 ECTS)

Skills acquired by the student:

- Learning to work properly in a chemistry laboratory.

- Learning to analyze and interpret laboratory data.

Evaluation:

- Compulsory attendance to the laboratory sessions. It will be taken into account the attitude, behavior and skills displayed during the development of the work in the laboratory.

- Elaboration of laboratory reports.

Activity 3: Problem-solving, including Formulation and Nomenclature of Inorganic Chemistry (1,4 ECTS)

Metodology: Seminaries in reduced groups of students (1,4 ECTS).

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Skills acquired by the student:

- Proper use of nomenclature in chemistry.

- Solving of basic chemistry problems.

Evaluation: Written test of problems andFormulation and Nomenclature of Inorganic Chemistry.

1. Formulation and Nomenclature of Inorganic Chemistry.

2. Problems: Stoichiometry, Solutions, Thermodynamics , Equilibria.

5.2.Learning activities

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

- Participative and interactive lectures: 40 hours in-class teaching.

The theoretical program of the subject is divided into 12 topics.

Inorganic Chemistry Department: Topic 1-5 and 10.

Physical Chemistry Department: Topic 6-9 and 11-12.

- Problem-solving sessions: 14 hours in-class teaching. They will be devoted to the following: I. Formulation and Nomenclature of Inorganic Chemistry (4 hours) and II. Resolution of numerical problems (10 hours), including: 1. Stoichiometry and composition; 2. Solutions; 3. Thermochemistry ; 4. Phase Equilibria ; 5. Chemical equilibrium ; 6. Solubility and acid - base equilibria; 7. Oxidation-reduction equilibria.

- Laboratory sessions: 6 hours in the laboratory, two sessions of 3hours each: 1. Introduction to laboratory work: Preparation of solutions of electrolytes and pH measurement ; 2. Determination of equilibrium constants.

- Study of theoretical knowledge to prepare the written test: 52 hours not in-class teaching (student's own work).

- Study of Formulation and Nomenclature: 10 hours not in-class teaching (student's own work).

- Problem-solving to prepare the written test: 18 hours not in-class teaching (student's own work).

- Making reports on laboratory work: 6 hours not in-class teaching (student's own work).

- Written test: 4 hours.

5.3.Program

1. THE ORIGIN OF THE ELEMENTS. NUCLEAR REACTIONS.

Introduction. The Nuclear Atom. Fundamental Particles: a Summary. Isotopy. The Concept of the Mole. Nuclear Stability. Nuclear Reactions and Artificially Induced Radioactivity. Nuclear Fission. Nuclear Fusion. Applications of Radioisotopes. Nucleogenesis of the Elements. Distribution of the Chemical Elements on the Earth.

2. EXTERNAL STRUCTURE OF ATOMS. THE PERIODIC TABLE AND ATOMIC PROPERTIES.

Classifying the Elements: the Periodic Law and the Periodic Table. A Modern Periodic Table: the Long Form. Evolution of the Atomic Model. External Structure of Atoms. Atomic Orbitals. Multielectron Atoms. Effective Nuclear Charge. Orbital Energy Diagrams. Electron Configurations of the Elements. Atomic Properties: Atomic Radius. Ionization Energy. Electron Affinity. Electronegativity. Atomic Properties and the Periodic Table: a Summary.

3. CHEMICAL BONDING I. MOLECULAR SUBSTANCES.

Chemical Bonding. Types of Substances According to Interactions between their Constituents. Lewis Theory. Covalent Bonding: an Introduction. Molecular Shapes: Valence Shell Electron Pair Repulsion (VSEPR) Theory. An Introduction to Valence Bond Theory. Bond Lengths and Bond Energies. Partial Ionic Character of Covalent Bonds. Polar and Nonpolar Molecules. Intermolecular Forces.

4. CHEMICAL BONDING II. NON-MOLECULAR SUBSTANCES.

Non-molecular Covalent Substances: Structure and Properties. Non-molecular Ionic Substances. Ionic Bonding: an Introduction. Crystal Structures. Ionic Crystal Structures. Energetics of Ionic Bond Formation and Application to Properties: Melting and Boiling Points. Solubility. Partial Covalent Character of Ionic Bonds: Polarization. Non-molecular Metallic Substances. Metallic Bonding: Nature and Properties. Conductors, Semiconductors and Isolators.

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5. RELATIONSHIPS INVOLVING ATOMIC COMPOSITION-CHEMICAL BONDIND-STRUCTURE-PROPERTIES.

Relationships between Atomic Composition and Bonding. Relationships between Bonding and Structure. Relationships between Structure and Properties. Study of Some Properties: Melting and Boiling Points. Solubility.

6. THERMODYNAMICS: INTRODUCTION AND GENERAL CONCEPTS.

The Laws of Thermodynamics. Thermochemistry. Gibbs Free Energy and Helmholtz Free Energy. Thermodynamic Tables. Thermodynamic Criteria for Equilibrium and Spontaneity.

7. PHASE EQUILIBRIA OF PURE SUBSTANCES.

Phase Rule. One Component Systems: Phase Diagrams of Pure Substances. Clapeyron Equation. Second-order Phase Transitions.

8. MULTICOMPONENT SYSTEMS.

Different Concentration Scales. Chemical Potential. Liquid Solutions: Ideal Solution and Ideal Dilute Solution. Solubilitiy of Gases in Liquids. Colligative Properties. Partition Equilibrium Constant. Electrolyte and Non-electrolyte Real Solutions: Activity Coefficients. Solid Solutions. Phase Diagrams.

9. CHEMICAL EQUILIBRIUM.

The Thermodynamic Equilibrium Constant. Gas Phase Reactions. Reactions in Heterogeneous Systems. The Effect of Temperature and Pressure on the Equilibrium Constant. Displacement of Chemical Equilibrium: Le Chatelier's Principle.

10. EQUILIBRIA IN AQUEOUS SOLUTIONS.

The Nature of the Aqueous Solutions. **Solubility Equilibria.** The Solubility Product Constant, *K* sp . Relationship between Solubility and *K* sp . Precipitation Reactions. Factors Affecting Solubility. **Acid-Base Equilibria:** a Brief Introduction and Overview. Brønsted-Lowry Theory. Self-Ionization of Water. pH and pOH. Neutralization Reactions. Ions as Acids and Bases: pH of Salt Solutions. Acid-Base Equilibria of Carbonate Anion. **Oxidation-Reduction Equilibria:** an Introduction. Oxidizing and Reducing Agents. Balancing Redox Equations.

11. ELECTROCHEMICAL SYSTEMS.

Definition of Mean Ionic Magnitudes. Electric Conductivity of Ionic Solutions. Equilibrium in Electrolyte Systems. Thermodynamics of Galvanic Cells: Nernst Equation. Standard Electrode Potential Table. Application of Potentiometric Measurements.

12. CHEMICAL KINETICS.

The Reaction Rate and Rate Constant. Order of Reaction and Molecularity. Integrated Rate Laws for First, Second and n-Order Reaction. Mean Lifetime. Effect of the Temperature on the Rate Constant. Catalysis.

5.4.Planning and scheduling

Schedule of lectures and problem-solving sessions will be those officially established and will be available at: https://ciencias.unizar.es/grado-en-geología .

The laboratory, schedule and groups for practical sessions will be established by the Coordinator at the beginning of the semester, to avoid overlapping with other subjects.

The course consists of 40 lectures (3 - 4 lessons per topic) and 14 problem-solving classes including Formulation and Nomenclature of Inorganic Chemistry.

Two laboratory sessions (3 hour-long each) will be carried out. Elaboration of reports must be completed in 1-2 weeks.

The theoretical lectures will be held three days a week, while the problem- solving classes will be held one day a week throughout the semester. Two laboratory sessions will be held during the months of November and December (Tuesday or Wednesday). Several laboratory turns will be organized.

The start time and duration of the theoretical examination of each call will be placed at least one week in advance on the bulletin boards of the Areas of Physical Chemistry and Inorganic Chemistry.

Each call shall include the theory and problems written test, as well as a Formulation and Nomenclature test and a laboratory examination for those students who did not pass these topics during the semester.

Finally, tutorials will be organized from the begining of the academic year, taking into account the other educational activities.

5.5.Bibliography and recomended resources

BB	Atkins, Peter William. Química : moléculas, materia,cambio / Peter Atkins, Loretta Jones ; traducción revisada y coordinada por Claudi Mans . - 3a ed. Barcelona : Omega, D. L. 1998

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BB	López Cancio, José Antonio. Problemas de química / José Antonio López Cancio, con la colaboración de Antonio Vera Castellano . - [1a ed.] Madrid [etc.] : Prentice Hall, 2000
BB	Química general : principios y aplicaciones modernas / Ralph H. Petrucci ... [et al.] ; traducción de Concepción Pando García-Pumarino y Nerea Iza Cabo ; revisión técnica de Juan A. Rodríguez Renuncio . - 10ª ed. Madrid [etc.] : Prentice Hall : Person educación, 2011
BB	Química general : principios y aplicaciones modernas / Ralph H. Petrucci ... [et al.] ; traducción, Concepción Pando García-Pumarino, Nerea Iza Cabo ; revisión técnica, Juan A. Rodríguez Renuncio . 10ª ed. Madrid [etc.] : Prentice Hall : Person educación, 2011 [Recomendado por Héctor Artigas]
BC	Atkins, Peter William. Química física / Peter Atkins, Julio de Paula . - 8ª ed. Buenos Aires [etc.] : Editorial Médica Panamericana, cop. 2008
BC	Chang, Raymond. Química / Raymond Chang; revisión técnica, Rodolfo Álvarez Manzo, Silvia Ponce López, Rosa Zugazagoitia Herranz ; [traducción, Erika Jasso Hernán D' Bourneville] . 10ª ed. México [etc.] : McGraw-Hill, cop. 2010 [Recomendado por Héctor Artigas]
BC	Díaz Peña, Mateo. Química física / M. Díaz Peña, A. Roig Muntaner . - 1a. ed., 6a. reimp Madrid : Alhambra, 1985-1986
BC	Química : la ciencia central / Theodore L. Brown ... [et al.] ; con la colaboración de Patrick Woodward ; traducción, Laura Fernández Enríquez ; revisión técnica, María Aurora Lanto Arriola . 11ª ed. México : Pearson Educación, 2009 [Recomendado por Héctor Artigas]
BC	Valenzuela Calahorro, Cristóbal. Introducción a la química inorgánica / Cristóbal Valenzuela Calahorro . - 2a ed.

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Aravaca, Madrid :
McGraw-Hill/Interamericana de España,
D.L.1999

LISTADO DE URLs:

http://www.webelements.com/ -
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