Universidad Zaragoza

Academic Year/course: 2021/22

29704 - Chemistry

Syllabus Information

Academic Year: 2021/22
Subject: 29704 - Chemistry
Faculty / School: 110 - Escuela de Ingeniería y Arquitectura
Degree: 330 - Complementos de formación Máster/Doctorado
434 - Bachelor's Degree in Mechanical Engineering
ECTS: 6.0
Year: 434 - Bachelor's Degree in Mechanical Engineering: 1
330 - Complementos de formación Máster/Doctorado: XX

Semester: 434-First semester o Second semester
330-First semester o Second semester
107-First semester
Subject Type: 434 - Basic Education
330 - ENG/Complementos de Formación
Module:

1. General information

2. Learning goals

3. Assessment (1st and 2nd call)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. It is based on participation and the active role of the student favors the development of communication and decision-making skills. A wide range of teaching and learning tasks are implemented, such as lectures, guided assignments, laboratory sessions, autonomous work, and tutorials.

Students are expected to participate actively in the class throughout the semester.

Classroom materials will be available via Moodle. These include a repository of the lecture notes used in class, the course syllabus, as well as other course-specific learning materials.

Further information regarding the course will be provided on the first day of class.

4.2. Learning tasks

The course includes 6 ECTS organized according to:

- Lectures (2 ECTS): 50 hours.
- Laboratory sessions (0.4 ECTS): 10 hours.
- Autonomous work (3.6 ECTS): 90 hours.
- Tutorials

Lectures: the professor will explain the theoretical contents of the course and solve illustrative applied problems. These problems and exercises can be found in the problem set provided at the beginning of the semester. Lectures run for 3-4 weekly hours. Although it is not a mandatory activity, regular attendance is highly recommended.

Laboratory sessions: sessions will take place every 2 weeks (5 sessions in total) and the last 2 hours each. Students will work together in groups actively doing tasks such as practical demonstrations, measurements, calculations, and the use of graphical and analytical methods.

Autonomous work: students are expected to spend about 90 hours to study theory, solve problems, prepare lab sessions, and take exams.

Tutorials: the professor's office hours will be posted on Moodle and the degree website to assist students with questions and doubts. It is beneficial for the student to come with clear and specific questions.

4.3. Syllabus

The course will address the following topics:

Chapter 1. Basic concepts of chemistry

1. Atoms and atomic theory. 2. Atomic structure. 3. An introduction to the periodic table. 4. Nomenclature. 5. Mass?s relations in chemistry: atomic mass, the concept of the Mol and molar mass, empirical and molecular formulas. 6. Chemical equation and stoichiometric calculations. 7. Types of chemical reactions. 8. Ways of describing solution composition.

PART II: Chemical Thermodynamics, Chemical Kinetics and Chemical Equilibrium

Chapter 2. Kinetic and thermodynamic aspects related to chemical reactions

2A. Chemical thermodynamics: 1. Energy, work and heat. 2. Heat of chemical reactions and thermochemical equations. 3. Hess?s law. 4. Standard enthalpies of formation and standard change in enthalpy for a given reaction. 5. Direction of the spontaneous processes: entropy, entropy change and standard free energy change.

2B. Chemical kinetics: 1. The rate of a chemical reaction: definition and factors affecting it. A Model for chemical kinetics.

Chapter 3. Chemical Equilibrium

1. The condition of dynamic equilibrium. 2. The equilibrium constant expression. 3. Relationship between DG^0 and the equilibrium constant. 4. Altering equilibrium conditions; Lechatelier principle.

Chapter 4. Ionic equilibria

1. Brønsted ?Lowry theory of acids and bases. 2. Self-ionization of water and the pH scale. 3. Strengths of acids and bases. 4. Hydrolysis. 5. Acid-base indicators. 6. Solubility equilibria: solubility product constant, Ksp. The common-ion effect in solubility equilibria.

Chapter 5. Redox equilibrium and electrochemistry.

1. Galvanic cells. 2. Standard hydrogen electrode (SHE) and reduction standard electrode potentials. 3. Nernst equation. 4. E_{cell}, ?G, and K. 5. Commercial galvanic cells. 6. Corrosion. 7. Electrolysis.

PART III: Basic Concepts of Chemistry II

Chapter 6. Periodic properties of the elements

Chapter 7. The chemical bond

1. - Ionic bonds. 2. - Covalent bonds. 3. - Metallic bonds. 4.- Intermolecular forces.

Chapter 8. - States of matter

8. A. Gases. 1. - Relationships among pressure, temperature, volume and amount of gas. 2. - The ideal gas equation. 3. - Mixture of gases: Dalton?s law of partial pressures. 4. - The kinetic molecular theory of gases. 5. - Diffusion and effusion: Graham?s law. 6. - The behavior of real gases: Van der Waals equation.

8. B Liquids and solids.-1. - Liquid-vapor equilibrium: vapor pressure and its temperature dependence, boiling point, critical point. 2. - Liquid-solid equilibrium: melting point. 3. - Solid-liquid equilibrium: sublimation point. 4. - Phase diagrams. 5.- Crystal structures. 6. - Correlation between bonding and properties of solids: Ionic solids, covalent solids, molecular solids and metallic solids.

Chapter 9. Physical properties of solutions

1. Types of solutions. 2. Thermodynamics of the solution process. 3. Solution concentration. 4. Effect of temperature on solubility. 5. Effect of pressure on solubility. 6. Colligative properties.

PART IV: Introduction to Organic and Inorganic Chemistry

Chapter 10. Introduction to Organic and Inorganic Chemistry

1. Elements: metals and non-metals. 2. Organic compounds: Hydrocarbons and functional groups.

4.4. Course planning and calendar

For further details concerning the timetable, classroom and further information regarding this course, please refer to the "Escuela de Ingeniería y Arquitectura " website (https://eina.unizar.es/)