

25200 - Chemical foundations of the environment

Información del Plan Docente

Academic Year	2018/19
Subject	25200 - Chemical foundations of the environment
Faculty / School	201 - Escuela Politécnica Superior
Degree	277 - Degree in Environmental Sciences 571 - Degree in Environmental Sciences
ECTS	6.0
Year	1
Semester	First Four-month period
Subject Type	Basic Education

Module

1.General information

1.1.Aims of the course

1.2.Context and importance of this course in the degree

1.3.Recommendations to take this course

2.Learning goals

2.1.Competences

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

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. A wide range of teaching and learning tasks are implemented, such as lectures, seminars and laboratory sessions.

All the proposed activities in this subject are focused on the understanding and assimilation of the chemistry principles to understand the different chemical processes that occur in the environment. Topics explained in lectures will be complemented in laboratory sessions.

A group work will be proposed at the beginning of the course, which will involve the discussion of a proposed topic in

25200 - Chemical foundations of the environment

collaboration with Fundamentals of Geology. Such topic will be closely related to contents included in both subjects: Chemistry and Geology. Also, individualized tutoring will monitor the learning process development.

4.2. Learning tasks

This course is organized as follows:

- **Lectures and seminars.** Students will receive the content of each lecture as well as the collection of numerical exercises at the beginning of each session.
- **Laboratory sessions.** These laboratory sessions will take 2 hours, approximately every 15 days. Students will have the content before the session, which includes the practical procedure and the theoretical contents.
- **Group work.** During the course students will be divided in groups of 4-5 members in order to develop a particular topic in collaboration with Fundamentals of Geology for the study of the environment. The proposed topic will be closely related to contents included in both subjects: Chemistry and Geology. All the students are encouraged to submit an individual report previous to the final group presentation, which will include a summary with the different sections of the topic in addition to the corresponding bibliography.

4.3. Syllabus

This course will address the following topics:

Lectures

- **Section 1: Atomic Structure**
 - o Unit 1. Atoms and atomic theory. The components of the atom. Introduction to the Periodic Table of Elements. Relationships of mass in chemistry: atomic mass, mole, empirical formula. Stoichiometry.
- **Section 2: State of Matter and Solutions**
 - o Unit 2. Gaseous State: Gas Properties. Laws of gases, ideal gas equations. Kinetic-molecular theory. Equation of real gases.
 - o Unit 3. Solid State: Types of solids. Van der Waals forces. Crystal structures.
 - o Unit 4. Liquid State: Liquids Properties. Liquid-vapour balance. Changes of state. Phase diagrams.
 - o Unit 5. Solutions: Units of Concentration. The basic fundamentals of solubility. Colligative properties.
- **Section 3: Thermodynamic Chemistry**
 - o Unit 6. Principles of heat transfer. The First Principal of Thermodynamics. Enthalpy. Thermodynamic equations. Enthalpy of formation, Bond Energy.
- **Section 4: Chemical Equilibrium**
 - o Unit 7. Equilibrium. Basic concepts of equilibrium. Constant of Equilibrium. Changes in the conditions of equilibrium.
 - o Unit 8. Acid-Base equilibrium: Definition of acid and base. Ionic product of water. pH and pOH. Strength of acids and bases. Buffer solution. pH indicators. Acid-base titration.
 - o Unit 9. Redox equilibrium: voltaic cells. Standard Potential. Relation between E^0 , K y DG^0 . Electrolytic and commercial cells.
 - o Unit 10. Precipitation equilibrium: constant of the product of solubility. Dissolving precipitates. Equilibrium of complex ions.
- **Section 5: Carbon Compound**
 - o Unit 11. Introduction to hydrocarbons: Alkanes, alkenes, alkynes. Functional organic groups.

Laboratory sessions

- **Session 1.** Production and behaviour of gases. Production of hydrogen. Determination of atomic weight of a metal.
- **Session 2.** Liquids and solutions. Concentration of solutions. Strong and weak electrolytes. Preparation of different solutions (sulphuric acid, hydrochloric acid, nitric acid, acetic acid, ammonium hydroxide and sodium hydroxide) to distinguish the behaviour of strong and weak electrolytes by measuring the pH.

25200 - Chemical foundations of the environment

- **Session 3.** Liquid solutions. Separation by distillation. Distillation of a commercial wine. Determination of alcoholic grade
- **Session 4.** Acids and Bases. Proton transfer reactions. Balances in solutions. Indicators. Recognize the behaviour of various indicators in different aqueous media: acid, basic and neutral. Study the acid-base behaviour of different salts depending on the colour they take on in the presence of an indicator. The study of different chemical equilibria.
- **Session 5.** Acid bases reactions. Neutralization. The study of a neutralization process by stage. Acid-base titration.
- **Session 6.** Oxidizing and reducing agents. Electron transfer reactions. Reaction of metals with the H⁺ ion (non oxidant acids) and with oxidant acids. Displacement reactions.
- **Session 7.** Chemical behaviour of alkaline earth metals and chemical behaviour of anions. Precipitation. Determination of an unknown salt

4.4.Course planning and calendar

Activity/Week	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Classroom activity														
Lectures	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Seminars	2		2		2	2		2			2	2		
Laboratory sessions						2	2		2	2	2		2	
Team work														
Evaluation									1					
Non face-to-face work														
Individual work	4	4	2	4	2	4	4	2	3	8	2	2	2	4
Team work			2		2			2		2	2	2	2	
TOTAL	8	8	8	8	8	8	8	8	8	8	8	8	8	8

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the Faculty of Sciences website and Moodle (<http://moodle.unizar.es/>).

4.5. Bibliography and recommended resources

- BB** Chang, Raymond. Química / Raymond Chang, Williams Co. traducción, María del Carmen Ramírez Medeles, Rosa Zugazagoitia Herranz ; revisión técnica, María Aurora Lant Arriola ... [et al.] . 7ª ed. México [etc.] : McGraw-Hill, cop. 2003
- BB** Kotz, John C.. Química y reactividad química / John C. Kotz, M. Treichel, Jr., Patrick A. Harman ; [traducción, Ma. Teresa Aguilar Ortega] . 5ª ed. [México] : Thomson, cop. 2003
- BB** Petrucci, Ralph H.. Química general / Ralph H. Petrucci, W. S. Harwood, F. Geoffrey Herring ; traducción, Concepción Gª Pumarino, Nerea Iza Cabo . 8ª ed. Madrid : Prentice Hall, cop. 2003
- BB** Química : la ciencia central / Theodore L. Brown...[et al.]; con la colaboración de Patrick Woodward ; traducción , Laura Fernández Enríquez ; Revisión técnica, María Aurora Lant Arriola . 11ª ed. México : Pearson Educación, 2009
- BC** Huheey, James E.. Química inorgánica : principios de estructura y reactividad / James E. Huheey, Ellen A. Keiter, Richard L. Keiter ; versión en español María Teresa Aguilar Ortega. 4a. ed. Madrid : Oxford University Press, cop. 2001
- BC** Manahan, Stanley E.. Environmental chemistry / Stanley E. Manahan . 8th ed. Boca Raton [etc.] : CRC, cop. 2005
- BC** Manahan, Stanley E.. Fundamentals of environmental chemistry / Stanley E. Manahan . 2nd ed. Boca Raton [etc.] : Lewis Publishers, cop. 2001
- BC** Peterson, W. R.. Formulación y nomenclatura química inorgánica [según la normativa IUPAC] / W. R. Peterson . 16ª ed. Barcelona : Edunsa, 1996
- BC** Peterson, W.R.. Formulación y nomenclatura química orgánica [según la normativa IUPAC] / W.R. Peterson . - 15a. ed. Barcelona : Edunsa, 1993
- BC** Shriver, Duward F.. Química inorgánica / D. F. Shriver, P. W. Atkins, C. H. Langford ; versión española [de la 2 ed. inglesa] : Gregorio López López . [1a] ed. española Barcelona [etc.] : Reverté, D.L.1997-1998

The updated recommended bibliography can be consulted in:
<http://psfunizar7.unizar.es/br13/egAsignaturas.php?id=10963>