Course guide
295501 - QDA - Aqueous Solution Chemistry

Last modified: 23/01/2024

Unit in charge: Barcelona East School of Engineering
Teaching unit: 713 - EQ - Department of Chemical Engineering.

Degree: BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: Gimenez Izquierdo, Francisco Javier

Others: Primer quadrimestre:
ADRIANA FARRAN MARSA - Grup: T31, Grup: T32, Grup: T33, Grup: T34
FRANCISCO JAVIER GIMENEZ IZQUIERDO - Grup: T31, Grup: T32, Grup: T33, Grup: T34
MARGARITA SÁNCHEZ JIMÉNEZ - Grup: T31, Grup: T32, Grup: T33, Grup: T34

Segon quadrimestre:
ADRIANA FARRAN - Grup de teoria T1. Grup: M31 i M32
FRANCISCO JAVIER GIMENEZ IZQUIERDO - Grup de teoria M3.
MARGARITA SÁNCHEZ JIMÉNEZ - Grup: M33, Grup: M34, Grup: T13, Grup: T14
NURIA BORRÁS - Grups T11 i T12

PRIOR SKILLS

REQUIREMENTS

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CEQUI-19. Understand mass and energy balances, biotechnology, mass transfer, separation operations, chemical reaction engineering, the design of reactors, and the recovery and processing of raw materials and energy resources.

Transversal:
04 COE N3. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.
05 TEQ N1. TEAMWORK - Level 1. Working in a team and making positive contributions once the aims and group and individual responsibilities have been defined. Reaching joint decisions on the strategy to be followed.
06 URI N3. EFFECTIVE USE OF INFORMATI0N RESOURCES - Level 3. Planning and using the information necessary for an academic assignment (a final thesis, for example) based on a critical appraisal of the information resources used.

TEACHING METHODOLOGY

The course consists of classroom classes where the teachers present the learning objectives related to the different contents and subsequently apply in the resolution of practical examples. The active participation of students during the resolution of practical cases is encouraged, proposing a good number of numerical problems and is motivated by proposals of real cases related to the field of chemistry.
Likewise, a series of sessions of laboratory practices (in schedule coinciding with the one of classes and with a calendar to be determined at the beginning of the course) are carried out where the student can carry out practical experiences in which the acquired knowledge is applied in class.
During the course, material and learning tools are provided to orientate and guide students in their learning process and to consolidate the knowledge about chemistry that is being achieved throughout the course.

LEARNING OBJECTIVES OF THE SUBJECT

The overall objective of the course is to establish the chemical bases necessary to interpret the most important chemical reactions that take place in aqueous solution and are applied in the field of Chemical Industry and the Environment.
At the end of the course students should be able to:
1. Predict the reactivity and stability of inorganic chemicals common
2. Write correctly differentiating the chemical reactions that are in chemical equilibrium.
3. Using the equations corresponding to the mass balance and electric charge as well as the constant need to interpret thermodynamic chemical equilibrium.
4. Calculate the concentrations of the different species in aqueous solution in equilibrium reactions: acid-base, complexation, solubility and oxidation-reduction.
5. Apply the calculation examples of systems in equilibrium in the environment and the chemical industry.
6. Use proper equipment and basic instrumentation of a chemical laboratory, conducting experiments during the course contents.

STUDY LOAD

Type	Hours	Percentage
Hours large group	45,0	30.00
Self study	90,0	60.00
Hours small group	15,0	10.00

Total learning time: 150 h

CONTENTS

Tema 1 Acid-base equilibria

Description:
Definitions of acidity and basicity, strong and weak acids and bases. Descriptive of the acids and bases most used in the industry. Acid-base reactions. Mass and charge balances. Constant of acidity. Monoprotic and polyprotics systems. Logarithmic diagrams. Acid-base applications: mixtures. Examples of environmental and industrial interest.

Related activities:
Two practical laboratory sessions to review, on one hand, basic concepts of stoichiometry and stoichiometric calculations and, on the other hand, the application of the concepts set forth in this chapter.

Full-or-part-time: 26h
Theory classes: 26h

Tema 2 Complexation equilibria

Description:
Importance of chemical speciation in dissolution. Some examples. Complexation equilibria. Formation constants. Mass balance. Degree of formation. Fraction diagrams. Predominance. Simultaneous reactions of complexation and acid-base. Examples of environmental and industrial interest.

Full-or-part-time: 8h
Theory classes: 8h

Tema 3 Solubility equilibria

Description:
Very soluble solids and little soluble. Concept of solubility and solubility constant. Solubility balances: material balances. Effects on solubility equilibria: common ion. Solubility diagrams Simultaneous reactions of solubility, complexation and acid-base. Examples of environmental and industrial interest.

Related activities:
Two sessions of laboratory practices, one to practice the concepts presented in this chapter and one that combines the concepts of this subject with those of the previous one.

Full-or-part-time: 18h
Theory classes: 18h

Tema 4 Oxidation-reduction equilibria (REDOX)

Description:
Concepts of oxidation, reduction, pe^o, pe. Semi reactions and global redox reactions. Calculation of redox balances. Simultaneous reactions of oxidation-reduction, solubility, complexation and acid-base. Diagrams of Pourbaix. Examples of environmental and industrial interest.

Related activities:
A practical laboratory session, to apply the concepts set forth in this chapter.

Full-or-part-time: 8h
Theory classes: 8h

GRADING SYSTEM

The lab score is based on the reports submitted at the end of each practice session. Also, it is required to deliver at the beginning of each practice a report . The final practice note (NP) will be obtained as the average of the different lab sessions and will constitute 20% of the final grade for the course. Failure to attend any practice without just cause or not having done previous work, the grade for the session will be zero.
The two partial tests (AC1 and AC2) made during the course constitute 40% of the final grade.
The remaining 40% will be obtained in the final exam (EF).
So: FINAL GRADE = 0.2*NP + 0.2*AC1 + 0.2*AC2 + 0.4*EF
There will not be a re-evaluation test.

EXAMINATION RULES.

Previous work to be presented at the beginning of the lab session as well as the script for the same will be given throughout the course, before each session.
Calculator is the only tool to be used in written tests.
The partial tests do not eliminate the matter.

BIBLIOGRAPHY

Basic:
- Casas, I.; Cortina, J.L.; Espriu, A. QDA : Grau Enginyeria Química. Llibre de problemes. Reprografia EEBE,
- Aguilar Sanjuán, Manuel. Introducción a los equilibrios iónicos. 2a ed. Barcelona [etc.]: Reverté, 1999. ISBN 8429175504.

Complementary:
- Pando García-Pumarino, Concepción; Iza Cabo, Nerea; Petrucci, Ralph H. Química general : principios y aplicaciones modernas [on line]. 11a ed. Madrid [etc.]: Pearson Prentice Hall, cop. 2017 [Consultation: 10/06/2020]. Available on: http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=6751. ISBN 9788490355343.

RESOURCES

Other resources: