

Course guide

240027 - 240027 - Chemistry II

Last modified: 13/06/2023

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

Degree: BACHELOR'S DEGREE IN INDUSTRIAL TECHNOLOGY ENGINEERING (Syllabus 2010). (Compulsory subject).

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

LECTURER

Coordinating lecturer: Ana Maria Sastre Requena

Others: Almajano Pablos, Maria Pilar
Corcho Sanchez, Francisco Jose
Gonzalez Fernandez, Oscar
Lalueza Baro, Juana
Pastor Castillo, Maria Vicenta
Sastre Requena, Ana Maria
Martinez Rodriguez, Maria

TEACHING METHODOLOGY

The module consists of lectures in which the professor presents the learning objectives related with the different contents and later a resolution of practical examples. Active participation is encouraged during the resolution of practical cases, while proposing a large amount of numerical problems in which students are presented with real cases related with the chemical environment.

LEARNING OBJECTIVES OF THE SUBJECT

The module's general objective is to establish a chemical basis necessary to interpret the most important chemical reactions which take place in aqueous dissolution and to apply in the Chemical Industry and Environment.

At the end of the module, students should be able to:

1. Predict the reactivity and stability of the most common chemical inorganic composites.
2. Correctly write chemical reactions differentiating those which take place in chemical balances.
3. Use the corresponding equations in the mass and charge balances as well as the necessary thermodynamic constants to interpret chemical balances.
4. Calculate the concentrations of different species in an aqueous dissolution for balanced reactions: acid-base, complexation, solubility and oxidation-reduction.
5. Applying calculus of balanced systems in environment's examples and in chemical industry examples.

STUDY LOAD

Type	Hours	Percentage
Hours large group	56,0	93.33
Hours small group	4,0	6.67

Total learning time: 60 h



CONTENTS

TOPIC 1. Chemical Kinetics

Description:

Chemical kinetics. Definitions. Rate law of a chemical reaction. Rate constant. Rate equations.

Full-or-part-time: 15h

Theory classes: 3h

Practical classes: 3h

Self study : 9h

TOPIC 2. Chemical Equilibrium

Description:

Equilibrium Constant. Le Chatelier's principle. Water as solvent. Electrolytes. Chemical equilibrium in solution. Henry's law

Full-or-part-time: 10h

Theory classes: 2h

Practical classes: 2h

Self study : 6h

TOPIC 3: Acid-base reactions

Description:

Acidity and basicity definitions, strong and weak acids and bases. Description of the most widely used acids and bases in industry. Acid-base reactions. Acidity constant. Charge and mass balances. Application of acid-base balances: mixtures. Environmental and industrial interest examples: Acid rain. CO₂ impact.

Full-or-part-time: 40h

Theory classes: 7h

Practical classes: 7h

Laboratory classes: 2h

Self study : 24h

TOPIC 4. Formation of complexes in dissolution

Description:

Chemical speciation. Predominance. Some examples. Complexation balances. Formation constants. Mass balances. Formation degree. Fraction diagrams environmental and industrial applications.

Full-or-part-time: 16h 30m

Theory classes: 3h

Practical classes: 3h

Laboratory classes: 0h 30m

Self study : 10h



TOPIC 5. Dissolution and precipitation

Description:

Soluble and insoluble solids, solubility, solubility product. Solubility balances: mass balances. Solubility diagrams applications. Precipitation and redissolution reactions. Parallel reactions.

Full-or-part-time: 31h 30m

Theory classes: 6h

Practical classes: 6h

Laboratory classes: 0h 30m

Self study : 19h

TOPIC 6. Redox reactions

Description:

Chemical reactions in high furnaces. Oxidation, reduction, pe. Semireactions and redox reactions. Redox reactions applications (batteries, piles, electrolysis). Pourbaix's diagrams. Environmental applications.

Full-or-part-time: 32h

Theory classes: 6h

Practical classes: 6h

Laboratory classes: 1h

Self study : 19h

TOPIC 7: Organic Chemistry: applications

Description:

Applications of organic reactions

Full-or-part-time: 5h

Theory classes: 2h

Self study : 3h

ACTIVITIES

(ENG) PROVA AVALUACIÓ CONTINUADA AC

Full-or-part-time: 1h

Self study: 1h

GRADING SYSTEM

The final mark (NF) will be calculated according to:

$$NF = \text{màx.} (EF, 0,2*EP+0,2*PAC + 0.05* NP+0,55*EF)$$

- 1) Continuous evaluation mark: PAC
- 2) Parcial exam mark: EP
- 2) Laboratori mark: NP
- 3) Final exam mark: EF

La nota final de Reavaluació es calcularà segons: $NF = 1.0*ReAv$

Nota de l'examen de Reavaluació: ReAv

- 1) Continuous evaluation mark: AC
- 2) Partial exam mark: EP
- 3) Final Exam mark: EF

The reassessment mark (ReAv) will replace the final exam mark.

Final mark will be calculated according to: $NF = 1.0 *ReAv$

EXAMINATION RULES.

Both in continuous evaluation tests and in the partial and final exams, and in the reassessment exam, it is necessary to have a calculator. It will not be possible to use notes or any type of formulary under any circumstance.

BIBLIOGRAPHY

Basic:

- CHANG, R., OVERBY, J. y ÁLVAREZ, R. Química [on line]. 13. McGraw-Hill/Interamericana Editores,, 2020 Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_Escritorio_Visualizar?cod_primaria=1000193&libro=10619. ISBN 9781456277161.
- Aguilar Sanjuán, Manuel. Introduccion a los equilibrios quimicos [on line]. Barcelona: Reverte, 1999 Available on: http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=8080. ISBN 8429175504.
- PETRUCCI, R.H., HERRING, F.G., MADURA, J.D., BISSONNETTE, C., PANDO GARCÍA-PUMARINO, C. y IZA CABO, N. Química general: principios y aplicaciones modernas [on line]. 11. Pearson Prentice Hall, 2017 Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_Escritorio_Visualizar?cod_primaria=1000193&libro=6751.

Complementary:

- SILVA, M., BARBOSA, J. Equilibrios iónicos y sus aplicaciones analíticas.. Madrid: Editorial Síntesis., 2002. ISBN 84-9756-025-6.
- ATKINS, P.W. (Peter W., JONES, L. y LAVERMAN, L.. Chemical principles: the quest for insight. Seventh edition. W. H. Freeman Macmillan Learning, 2016. ISBN 9781464183959.

RESOURCES

Other resources:

In the ATENEA's platform, more information relative to the laboratory practice, questionnaires, self-evaluation multiple choice tests.