Universitat Autònoma de Barcelona

2019/2020

Chemical Equilibrium

Code: 102412
ECTS Credits: 6

Degree	Type	Year	Semester
2500897 Chemical Engineering	OB	1	2

Contact

Name: Francisco Céspedes Mulero
Email: Francisco.Cespedes@uab.cat

Use of Languages

Principal working language: spanish (spa)
Some groups entirely in English: No
Some groups entirely in Catalan: No
Some groups entirely in Spanish: Yes

Prerequisites

Basic knowledge of general chemistry. General knowledge of the elements of the Periodic Table and its reactiviti

Objectives and Contextualisation

Context

The Chemistry Balance course is taught in the Degree in Chemical Engir

Targets

Acquire the basic knowledge to understand and solve the problems relat

Competences

- Apply relevant knowledge of the basic sciences, such as mathematics, chemistry, physics and biology, and the principles of economics, biochemistry, statistics and material science, to comprehend, describe and resolve typical chemical engineering problems.
- Apply scientific method to systems in which chemical, physical or biological transformations are produced both on a microscopic and macroscopic scale.
- Apply the acquired knowledge and skills to develop a chemical engineering project.
- Develop personal work habits.
- Develop thinking habits.

Learning Outcomes

1. Apply scientific method to the fields of dissolution equilibrium and organic chemistry.
2. Develop independent learning strategies.
3. Develop scientific thinking.
4. Identify the reactions in which changes in oxidation states are produced and understand the principles governing the spontaneity of these reactions as well as the main applications and consequences of electrochemical processes.
5. Recognise the different processes for acid-base evaluation by means of their curves and be able to choose the suitable indicator.
6. Recognise the main utensils of the chemical laboratory and use them adequately to carry out basic laboratory operations.
7. Understand the importance of regulatory dissolutions and apply them to the generation of controlled acidic mediums.
8. Understand the nature of acid-based equilibriums and analyse them by means of balances of matter and load, both in the case of monoprotic and polyprotic species.
9. Understand the principles governing the processes of extraction and precipitation and apply them to the interpretation of heterogeneous phase equilibriums.
10. Use the knowledge acquired in the design of analyses and processes.

Content

Theoretical content

I.- Introduction

Lesson 1: Free energy: criterion of spontaneity. Relationship between DGo and the state of equilibrium. Balance constant of a reaction. Dependence of the equilibrium constant with the temperature. Expressions of the equilibrium constant. Principle of Le Chatelier

Lesson 2: Introduction to the study of ionic balance. Electrolytes Theory of Arrhenius. Characteristics of water as a solvent

II. Acid-base equilibrium

Lesson 3: Acids and bases. Historical theories and definitions. Self-ionization of water. Definition of pH. Relative force of an acid-base pair, pKa

Lesson 4: Balance of matter in strong and weak electrolytes. Rule of electronauthenticity. Electric balance. Rigorous pH calculation of an aqueous solution of a base acid pair. General formula

Lesson 5: Calculation of the pH of a dissolution of an acid or a base. Calculation of pH in mixtures of acids and conjugated bases. Regulatory dissolutions of the pH: preparation and properties. Calculation of the pH of mixtures of acid-base pairs. Polypropic acids

Lesson 6: Acid-base volumes. Amortising solution Amortizing capacity Neutralization curves Strong and weak protoples, monoprotic and polyprotics. Acidimetry and alkalimetry. Valuable solutions. Primary types Acid-base indicators

III. Balances of complex formation

Lesson 7: Introduction. Agreements. Lewis Acids. Constants of stability and constants of complex formation. Complexes and acids

IV.- Precipitation balances

Lesson 8: Solubility and solubility product of a soluble solid in water. Effectof other solutes on the solubility of a substance. Effect of temperature on solubility of a solid

Lesson 9: Solubility and acidity. Solubility and complexation. Fractional precipitation

V.- Oxidation-reduction balances

Lesson 10: Degree of oxidation. Definitions Electrochemical batteries Agreements. Measure of the f.e. of a pile Equation of Nernst

Lesson 11: Electrode potential. Normal potential Reduction potential at 25oC. Factors that influence the potential of electrode: acidity of the medium, precipitation of some of the redox pair species. Applications PH measurement Glass and reference electrodes

Practical sessions

Practice 1. Balances. Volumetric material

Theory: Measures of mass. Volumetric measures. Units of concentration. Disputes. Density

Laboratory: Weighing technique. Determination of the density of standard solutions. Calculation of the concentration of a solution of sodium chloride from the determination of its density.

Practice 2. Determination of the degree of acidity of a commercial vinegar

Theory: Acid-base volume.

Laboratory: Evaluation of the degree of acidity of a commercial vinegar.

Practice 3. Measure the pH. Relative strength of acids and bases

Theory: Acids and bases. PH scale PH-meter.

Laboratory: Relative strength of acids and bases. Hydrolysis of salts. Shock absorbers and non-shock absorbers.

Practice 4. Simple extraction

Theory: Concept of simple extraction. Theoretical foundation. Extraction equipment Emulsions

Laboratory: Separation of a mixture of benzoic acid, 1,3-dinitrobenzene and aniline. Extraction with a basic aqueous and acid phase.

Practice 5. Separation and purification of solids

Theory: The burner Bunsen. Filtration by gravity and suction.

Laboratory: Separation of the components of a mixture. Filtration and sublimation. Identification of compounds

Methodology

Although the teacher will use the master class to transmit knowledge of the nuclear aspects of each subject, the student must be an active part of the learning process (interactive master class). In this sense, initiatives on inquiry, motivation and the process of knowledge of things will be promoted, having the student to create them and adapt them to their own learning process. The students will carry out laboratory practices with the aim of completing and reinforcing the knowledge acquired in the theoretical classes and seminars. The teacher will carry out orientation, guidance and reinforcement tasks of those aspects that present more difficulty. There will be plenty of bibliographical material available to students, including theoretical contents and also exercises. To encourage critical reasoning, discussion and reflection on the part of the student, work groups will be enabled in the problem classes and in the seminars in order to complete the learning process through group discussion.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Laboratory sessions	20	0.8	
Master classes	22	0.88	
Problem classes	11	0.44	
Seminars	5	0.2	
Type: Supervised			
Tutorials scheduled	7	0.28	
Type: Autonomous			
Self study	76.5	3.06	

Assessment

The assessment will be individual and will be carried out continuously in the different training activities that have l

Individual written tests: Three partial exams will be done that will include the contents covered in the different less

At the end of the course, it will be possible to perform a recovery test for all students with the subject not passed

Laboratory reports: 5 practical sessions are programmed. The practices will be done in pairs. At the end of each

The note of each report will be the mark obtained for each member of the pair of students. All practical sessions

The professor responsible for the subject will evaluate the cases of faults justified by the student. The note obtai

The total weight of the final mark of practices will be 20% on the final mark of the subject.

Delivery of exercises and works: Throughout the course the student will have to deliver exercises that will be pro

In no case will the days scheduled for the exercises be scheduled and there will be no prior notice. All exercises

Attitude in the formative activities: Active participation, face-to-faceassistance, as well asthe attitude in the differe

It will be considered
NOT EVALUABLE as a final grade when any of these cases are met:

- Missing all laboratory practice sessions

- Do not perform individual written tests (partial) and do not do the FINAL exam

To pass the subject, it is necessary to obtain a score equal to or greater than 5.0 on 10 in the
FINAL NOTE while satisfying the following conditions:

- Have laboratory practices with a average grade equal to or greater than 5.0 out of 10

- Be attended to all the sessions of laboratory practices (2 theoretical + 5 practices). If there is any lack of assis

- Have a mark equal to or greater than 4.5 out of 10 in the average mark of the individual written tests (partial).

Right to the recovery exam:

- In the event of not approving the subject with all the requirements mentioned above, the student will be entitle
RECOVERY EXAMINATION OF ALL THE MATTER.

To pass the subject and do the weighted average of this recovery test with other evaluable activities, it is man
RECEIPT EXAMINATION NOTE equal to or greater than 5.0, but in this case, only the weighted average will be

with one value of NOTA RECOVERY EXAM equal to 5.0.

- Once the weighted average of all the activities evaluated has been done, to pass the subject, the FINAL NOT

FINAL NOTE (for partial) = PARTIAL NOTE ($\geq$ 4.5) * 0.75 + PRACTICAL NOTE ($\geq$ 5) * 0.20+ (EXERCISES + AT

FINALNOTE (ex. recovery) = NOTE RECOVERY EXAM (all subject)(5.0 if the NOTE RECOVERY EXAM $\geq$ 5.0)

If the PARTIAL NOTE is <4,5 and / or the NOTE RECOVERY EXAM is <5.0, the academic record will be a note

Any student suspected of having a lab report of more than 6.5 out of 10, will be able to keep this note (only 1 yea

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Completion of work and problem solving. Attitude	5%	2	0.08	9, 7, 8, 3, 2, 5
Realization of three partials	75%	4.5	0.18	9, 7, 8, 4, 5
Realization of laboratory reports	20%	2	0.08	1, 3, 2, 5, 6, 10

Bibliography

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Campus virtual de l'assignatura