Universitat Autònoma de Barcelona

2019/2020

Fundamentals of Chemistry

Code: 100915
ECTS Credits: 6

Degree	Type	Year	Semester
2500253 Biotechnology	FB	1	1

Contact

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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: No

Teachers

Dídac Armand Fenoll Silvestre

Anna Cebrian Prats

Prerequisites

Although there are no official prerequisites, it is advisable for the student to review the general concepts of chemistry, physics and mathematics acquired in the secondary education.

Objectives and Contextualisation

The general objective is to intruduce the student to the fundamental concepts of Chemistry. In the long run, it is intended that the student becomes aware of the importance of Chemistry and become familiar with these fundamental concepts od Chemistry.

The aim is to help the student to understand the chemical phenomena of the macroscopic world and to introduce him into the knowledge of the interactions between atoms and molecules at the microscopic level (through the atomic structure and bonding).

the main bases to understand the structure of matter at the microscopic level will be studied, relating them to the type of bond. We will present the basic concepts of chemical thermodynamics that will allow rationalization of macroscopic behavior and the concept of chemical equilibrium. Then, the most common equilibria will be studied and the basic notions of chemical kinetics will be presented.

Main objectives of the subject:

1) Introduce the microscopic vision of chemistry.

2) Knowing the macroscopic interpretation of chemical phenomena:

a. Chemical thermodynamics

b. Chemical equilibrium

c. Chemical kinetics

Competences

- Read specialised texts both in English and ones own language.
- Reason in a critical manner
- Think in an integrated manner and approach problems from different perspectives.
- Use the fundamental principles of mathematics, physics and chemistry to understand, develop and evaluate a biotechnological process.

Learning Outcomes

1. Correctly manipulate chemical equations, equalise them and make stechiometric calculations.
2. Describe and determine the factors and parameters that affect the velocity of a reaction.
3. Determine concentrations when any chemical equilibrium is established from the thermodynamic parameters that quantify it.
4. Predict the spontaneity of a reaction from changes in entropy, enthalpy and associated free energy.
5. Read specialised texts both in English and ones own language.
6. Reason in a critical manner
7. Think in an integrated manner and approach problems from different perspectives.

Content

1. Atomic structure
Hydrogen atom. Polyelectronic atoms. Electronic configurations. Periodic table. Periodic properties.
2. Chemical bond
Chemical bonding models. Covalent bond Lewis structures. Molecular geometry Polarity Hybrid orbitals Molecular orbitals
3. Intermolecular forces
Hydrogen bonding. Vander Waals Forces

. First law of thermodynamics.
Thermodynamic systems. Internal energy Heat and work. First law of thermodynamics. Reaction heat and standard states. Law of Hess.
5. Second law of thermodynamics.
Spontaneity. Entropy. Second principle of thermodynamics. Enterpic Change. Third principle of thermodynamics. Gibbs Energy
6. Definition of chemical equilibrium
Dynamic equilibrium. Expression of the equilibrium constant. Gibbs energy and equilibrium. Criterion of spontaneity. Variation of $\Delta_r G^o$ and K with the temperature. Principle of Le Chatêlier.
7. Acid-base equilibria
Acids and bases of Brønsted and Lowry. Constants of acidity and basicity. Concept and pH calculation. Buffer solutions
8. Electrochemistry
Equalization of redox reactions. Electrochemical cells. Cell potential. Standard chemical and biochemical reduction potentials. Equation of Nernst.
9. Fundamental concepts of chemical kinetics.
Reaction rate. Rate laws. Reaction order. Dependence of the rate constant with the temperature.
10. Reaction Mechanisms
Rate determining step. Approximation of the stationary state. Catalysis

Methodology

Master classes:

The student acquires the scientific-technical knowledge of the subject by attending master classes and complementing them with personal study of the topics explained.

The master classes are the activities that require less active participation by the student, since they are conceived as the transmission of knowledge by the teacher. However, its use greatly helps the achievement of knowledge.

Problem solving classes:

In these the scientific-technical knowledge exposed in the lectures will be put into practice through problem solving. Since the number of students in class will be half that in theory, active participation by students may be required.

practices:

Although in this subject there is no practical part, some of the practices that will be carried out in the Integrated Laboratory course are directly related to the concepts introduced in this subject.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Exercises	15	0.6	2, 3, 1, 7, 4, 6
Theory lessons	30	1.2	2, 3, 1, 7, 4, 6
Type: Autonomous			
Problem solving and other activities	38	1.52	
Study of the theoretical concepts	52	2.08	2, 3, 5, 1, 7, 4, 6

Assessment

The assessment will be carried out throughout the course:

Evaluation through review activities: Throughout the course, some review activities will be considered consisting of exercises that collect the main content of the subject and can be solved individually or in groups, self-assessments on the virtual campus, short tests in class, etc ... These are intended Help the student to review the content of the subject.

The qualification of these activities will be equal to 20% of the final score and does not require a minimum to average the rest of the qualifications.

Evaluation by means of written tests: in this part, the scientific-technical knowledge of the subject obtained by

the student, as well as his capacity for analysis, synthesis and critical reasoning, is evaluated individually.

Partial written tests: During the course two partial tests will be carried out that will evaluate the contents of the subject taught until that moment. Each partial test will have a weight of 40% of the final qualification of the subject. It will be necessary to achieve a 5.0 in each one of them so that it is done with average other qualifications of the subject. Students who do not score 5.0 in any of these tests must present themselves to the final test of the suspended part.

Final written test: Students who have not obtained at least 5.0 to one of the partial tests must attend this test. Exceptionally, students who have passed the partial tests may wish to submit a note. Even so, by doing so, they renounce the partial note. It will be necessary to obtain a minimum of 5 out of 10 to make average with the rest of the qualifications.

The students who have not been evaluated in a minimum of 2/3 parts of the total of evaluable activities or who have obtained a qualification inferior to 3.5 points out of 10 in the average of the two written tests written in the final will not be able topresent to the final test .

The global qualification will be:

Global Score = (Activity Review) * 0.2 + (Exams) * 0.8

To overcome the allocation, it will be necessary to exceed 5.

Use unauthorized methods during one of the examinations of the subject (copy or communicate with a colleague, use of cell phones, etc.) will be penalized with a "suspense" rating in the global subject of the subject. current course

Non-evaluable students

It is considered that a student is assessable when he has given 2 or more of the problems or is presented in the first partial test

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Partial examination	40% each one	5	0.2	7, 6
Review activities	20%	10	0.4	2, 3, 5, 1, 7, 4

Bibliography

Bibliography

General textbooks of Physical Chemistry that encompass all the subject matter of the course:

- R. H. Petrucci, W. S. Harwood, F. G. Herring Química General Pearson Pentrice Hall (8ena Ed.) 2009.
- R. H. Petrucci, F. G. Herring, J. D. Madura, C. Bissonnette, Química General, Pentrice Hall (10ena Ed.) 2011.
- P. Atkins, L. Jones Principios de química Editorial Medica Panamericana (5ena Ed.) 2010.

Advanced texbooks:

- P. Atkins, J. de Paula Physical Chemistry, Oxford University Press (9ena Ed.) 2010

web:

Virtual space of the subject: http://cv.uab.cat