UAB
Universitat Autònoma de Barcelona

Chemical Reactivity

Code: 106800
ECTS Credits: 6

2024/2025

Degree	Type	Year
2504602 Nanoscience and Nanotechnology	FB	1

Contact

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Teaching groups languages

You can view this information at the end of this document.

Prerequisites

It is recommended that those students who have not studied Chemistry in High School to attend the chemical courses that the Faculty of Science organizes at the beginning of September.

Objectives and Contextualisation

The general objectives of the subject are to establish the fundamental concepts that allow understanding chemical reactions and to be able to relate them with other more specific subjects of the Degree of Nanoscience and Nanotechnology. These bases will allow the student to identify and apply the principles and their meaning to solve real world problems in a systematic and fast way and increase their critical and learning abilities.

The subject offers the students the fundamental principles of chemistry, their applications and qualitative and quantitative reasoning. Examples of the real world and more specifically of the field of Nanoscience will be given. The following areas will be emphasized: thermochemistry, homogeneous and heterogeneous equilibria, chemical kinetics, and basic electrochemistry.

Learning Outcomes

1. CM03 (Competence) Determine relevant parameters and magnitudes associated with chemical equilibrium and reactivity.
2. CM04 (Competence) Work collaboratively in teams to solve problems and practical cases in general chemistry.
3. CM05 (Competence) Work autonomously to plan the work involved in supervised activities.
4. KM07 (Knowledge) Identify the concepts, principles and theories of thermochemistry, homogeneous and heterogeneous equilibria, chemical kinetics and electrochemistry.
5. SM05 (Skill) Gather, analyse and adequately represent data and observations in the field of general chemistry, using magnitudes, units and terminology associated with basic chemical concepts.
6. SM05 (Skill) Gather, analyse and adequately represent data and observations in the field of general chemistry, using magnitudes, units and terminology associated with basic chemical concepts.
7. SM06 (Skill) Determine the properties of elements and simple molecules by applying Lewis theory, valence bond theory and molecular orbital theory.

8. SM07 (Skill) Accurately carry out calculations based on simple chemical reactions from a thermodynamic and kinetic point of view in order to predict their evolution.
9. SM08 (Skill) Safely handle instruments and materials typically found in a general chemistry laboratory.

Content

1. Thermochemistry: Reaction heat and calorimetry. Work-energy. First law of thermodynamics. Heats of reaction: ΔU and ΔH. Hess' Law. Standard enthalpies of formation. Calorimetric techniques.

2. Principles of chemical equilibrium: Concept of chemical equilibrium, expressions and relationships between the equilibrium constants. The reaction quotient Q. Modifications of the equilibrium conditions: Le Châtelier's principle. Examples.

3. Spontaneity and equilibrium: Spontaneity and Entropy. Second law of thermodynamics: Gibbs Energy. Relationship between Gibbs energy and equilibrium constant. Prediction of chemical change. ΔG^o and K_{eq} depending on the temperature.

4. Introduction to chemical kinetics: Reaction rate and temperature. Rate measurement. Rate equations and order of reaction. Reaction rate and temperature. Catalysis.

5. Acids and Bases (I): Review of Arrhenius theory. Bronsted-Lowry theory. Self-ionization of water and pH scale. Strong acids and strong bases. Weak acids and weak bases. Polyprotic acids. Ions as acids and bases. Lewis' acids and bases.

6. Acids and Bases (II): Common ion effect in acid-base equilibria. Buffer solutions. Indicators. Neutralization reactions and titration curves. Polyprotic acid solutions. Calculations.

7. Solubility and complexation: Solubility product and solubility. Common ion effect. Total and partial precipitation. Solubility and pH. Complexation equilibrium.

8. Electrochemistry: Redox reactions. Electrode potential and standard electrode potential. Relationship between E, ΔG^o and K_{eq}. Energy variation with the concentration: Nernst equation. Corrosion

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Exercises lessons	14	0.56	
Laboratori instructions reading	8	0.32	
Laboratory Practices (experimental part)	6	0.24	
Theoretical Lessons	30	1.2	
Type: Autonomous			
Study and exercise solving	86	3.44	

The subject Chemical Reactivity consists of two types of supervised activities, theoretical lessons and problem classes, which are distributed throughout the course.

Theoretical lessons.
Through the teacher's presentations, the student must acquire the specific knowledge of this subject and complement it with the study of each topic treated with the help of the material that the teachers can provide to the student through of the Virtual campus and the recommended bibliography. The theoretical lessons will be open to the participation of the students, who will be able to ask the teacher the questions and clarifications they consider necessary.

Exercises lessons.
The aim of this supervised activity is to solve problems and questions that have previously been posed to the students through the Virtual Campus and that they have previously had to solve, in groups or individually Due to the reduced number of students in class during this activity, the aim is to stimulate students' participation in the discussion of alternatives to solve the problems, taking advantage of this to consolidate the knowledge acquired at the theory lessons and during the autonomous work.

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Assessment

Continous Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Evidences	10% of final grade	4	0.16	CM03, CM04, CM05, KM07, SM06, SM07
Practices rerport writing	12% of the final grade	2	0.08	CM04, SM05, SM07, SM08

CONTINUOUS ASSESSMENT

The final grade of the subject is obtained from the grades of the exams, the continued work of the student (evidence of learning), and the laboratory practices.

Final course grade = 0.10 x (continued work grade) + 0.70 x (average grade of the subject exams) + 0.20 x (laboratory practices)

Average of the exams of the subject = 0.50 x (1st term exam grade) + 0.50 x (2nd term exam grade)

To pass the subject, the final grade of the subject must be $\geq$ 5.0 and the following three conditions must be met:

1) the average grade of the subject exams must be $\geq$ 4.0 (out of 10)

2) the exam grade of each exam term must be $\geq$ 3.5 (out of 10)

3) the laboratory practices grade must be $\geq$ 4.0 (out of 10)

Students who do not pass the subject for not meeting any of the three previous conditions, regardless of whether the final course grade is greater than or equal to 5.0, will obtain a maximum final grade of 4.5 considering the subject suspended.

Continued work (10%):

1) Evidence will be collected from each student throughout the entire semester (problems solved individually or in groups, self-assessments on the virtual campus, short tests in class, quizzes, etc...).

2) The grade for the continued work will be the average of the grade for the evidence collected throughout the course. The fact of not appearing to evidence implies a zero in that evidence.

Exams (70%):

1) There will be an exam at the end of each part of the subject (1st term exam and 2nd term exam).

2) At the end of the semester, recovery exams for the two parts will be offered (second option exams). To participate in the second option exams, students must have been previously evaluated in a set of activities whose weight is equivalent to a minimum of two-thirds of the subject's total grade. There is the possibility that students who do not need it can take second option exams to improve their course grade.

- For students who take these second option exams, the grade for the partial exam will be the one they get in this second option exam.

- For students who take these second option exams (grade improvement), the exam grade for the partial will be:

- equal to that of the second option exam, if the grade of the second option exam > term exam grade
- equal to the average of the term exam and the second option exam, if the grade of the second option exam < term exam grade.

Laboratory practices (20%):

The final grade of the laboratory practices will be calculated based on the laboratory reports (60%) and the exam of the knowledge acquired in the laboratory (40%).

Using unauthorized methods during one of the subject exams (copying or communicating with a classmate, use of mobile phones, use of smart watches, etc...) will be penalized with a grade of "suspension" in the overall subject of the current course.

To attend an exam of any partial it is essential to bring an identification document (DNI or university card) with a recent and good quality photograph.

UNIQUE ASSESSMENT

Within the regulatory period established by the University, students can request the unique assessment, while waiving the continuous assessment. Students who have accepted this unique assessment modality will have to take a final test which will consist of an examination of the entire theoretical syllabus and problems of the subject. This test will be carried out on the day on which the students of the continuous assessment take the second term exam.

The student's qualification will be:
Final course grade = 0.80 x (average grade of subject exams) + 0.20 x (practical grade)

If the final grade does not reach 5.0; students will be able to take a second option exam for the entire course (part 1 + part 2). This exam will also consist of two tests (1st part and 2nd part), and the same requirements will be required to pass (minimum 3.5 in each test and 5.0 in the final course grade).

Students who do not pass the subject because the grade in one of the tests is < 3.5, regardless of whether the final course grade is greater than or equal to 5.0, will obtain a maximum final grade of 4.5, considering the subject as failed.

These tests and the make-up test will coincide with the dates of the 2nd partial and make-up exams for students who opt for the continuous assessment.

Using unauthorized methods during one of the subject's exams (copying or communicating with a classmate, use of mobile phones, use of smart watches, etc...) will be penalized with a grade of "failed" overall of the subject of the current course.

To attend an exam of any partial it is essential to bring an identification document (DNI or university card) with a recent and good quality photograph.

Qualification of "NOT ASSESSED":

The qualification of "NOT ASSESSED" will be obtained in the following cases:

• There is no grade for laboratory practices (attendance at practice classes is mandatory).

• When the student has not participated in any of the assessment activities of one of the partials into which the subject is divided (exams and continued assessment).

Bibliography

Textbook:
- "Química General". Ralph Petrucci, Wiliam Harwood, Geoffrei Herring. Prentice-Hall (Pearson) 10a Edició, 2011. ISBN: 9788483226803
https://bibcercador.uab.cat/permalink/34CSUC_UAB/avjcib/alma991006206279706709

Other support books:
- "Química", Raymond Chang, Kenneth A. Goldsby. 11a Edició. Editor MacGraw Hill, 2013. ISBN 978-6071509284
- "Principios de Química", P. Atkins i L. Jones, Médica Panamericana, 3ª edició, 2006. ISBN 950-06-0080-3
- "Equilibrios iónicos y sus aplicaciones analíticas" Manuel Silva, José Barbosa. Ed. SINTESIS, 2002. ISBN: 9788497560252

Software

None

Language list

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	1	Catalan/Spanish	second semester	afternoon
(PAUL) Classroom practices	2	Catalan/Spanish	second semester	afternoon
(PLAB) Practical laboratories	1	Catalan/Spanish	second semester	morning-mixed
(PLAB) Practical laboratories	2	Catalan/Spanish	second semester	morning-mixed
(TE) Theory	1	Catalan/Spanish	second semester	afternoon