UAB
Universitat Autònoma de Barcelona

Chemistry

Code: 107595
ECTS Credits: 6

2025/2026

Degree	Type	Year
Physics	FB	1

Contact

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Teachers

(External) Raphael de Paiva

Teaching groups languages

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

Prerequisites

Although there are no official prerequisites, it is highly advisable that the student has taken chemistry during high school.

Objectives and Contextualisation

The general objective of the subject is to arouse in the student an interest in the phenomena of nature that are in the field of chemistry, that is: the study of matter from an atomistic point of view, and the awareness that this study is based on the general laws of the physical world.

At the same time, it is also intended that the knowledge acquired will allow the student to broaden their field of vision, and therefore, their job possibilities.

Partial objectives of the subject are:

1) Understand the nature of the chemical bond and how the molecular structure allows us to rationalize the intermolecular interactions that lead to the existence of different states of matter.

2) Understand the basic concepts of chemical kinetics and chemical equilibrium, and know how to apply them in real examples.

Learning Outcomes

1. CM07 (Competence) Estimate the relevant parameters and magnitudes associated with the structure of matter at the atomic and macroscopic scale.
2. CM08 (Competence) Estimate the relevant parameters and magnitudes associated with chemical equilibrium and reactivity.
3. KM06 (Knowledge) Identify the chemical bond, intermolecular forces, and aggregation states of matter.
4. KM07 (Knowledge) Describe the concepts, principles and theories about the structure of the atom and matter, relating these to their properties.
5. KM08 (Knowledge) Identify the concepts, principles and theories in the field of chemical kinetics, thermochemistry, electrochemistry and acid-base balance.
6. KM08 (Knowledge) Identify the concepts, principles and theories in the field of chemical kinetics, thermochemistry, electrochemistry and acid-base balance.
7. SM04 (Skill) Determine the properties of elements and simple molecules by applying Lewis theories, Valence Bond Theory, and Molecular Orbital Theory.
8. SM05 (Skill) Determine the properties of solids from intermolecular forces and chemical bonding.
9. SM06 (Skill) Correctly calculate processes related to simple chemical reactions from the thermodynamic and kinetic point of view to predict their evolution.

Content

1. The periodic table of the elements.
States of aggregation of matter. Atomic number and atomic mass. Isotopes Hydrogen atom. Quantum numbers. Orbitals. Interpretation and representation of orbitals. Electronic spin. Polyelectronic atoms. Electronic configurations and the periodic table. Metals, non-metals and their ions. Magnetism. Atomic and ionic radii. Ionization potential. Electronic affinity. Electronegativity.

2. The covalent bond.
Lewis theory. Polar covalent bond: electronegativity. Lewis structures: construction. Formal charge. Resonance. Exceptions to the octet rule. Molecular geometry: dipole moment. Bond order, distance and bond energy. Valence bond theory: hybridization. Molecular orbital theory. Species with delocalized electrons. Intermolecular forces. Van der Waals forces.

3. Metallic bonding.
Types of solids. Band theory in metals. Intrinsic and extrinsic semiconductors. X-ray diffraction. Crystal structures. The unit cell. Density and percentage of space occupation. Close packing of spheres (bcc, fcc, hcp).

4. Ionic bonding.
The ionic network. Ionic crystal structures. Rationalization of structural characteristics. Energy aspects in the ionic bond: lattice energy. Born-Haber cycles. Born-Landé equation. Polarizability of ions. Degree of hydration and thermodynamics of the dissolution process

5. Kinetics and thermodynamics of chemical reactions.
Chemical reactions. Reaction rate. Rate law. Factors that affect the rate of reactions. Arrhenius equation. Thermochemistry. Spontaneity of reactions. Chemical equilibrium. Relationship between Gibbs energy and equilibrium constant. Modification of equilibrium conditions: Le Châtelier's principle. Variation of the equilibrium constant with temperature.

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			

Learning results	140	5.6	CM07, CM08, KM06, KM07, KM08, SM04, SM05, SM06, CM07

The center of the learning process is the work of the students. They learn by working, and the mission of the teachers is to help them in this task (1) by providing them with information or showing them the sources where it can be obtained and (2) by accompanying their steps so that the learning process can be carried out effectively. In line with these ideas, and in accordance with the objectives of the subject, the development of the course is based on the following activities:

Theoretical classes:

Students acquire the scientific and technical knowledge specific to the subject by attending classes and participating in the construction of their own knowledge. In these, explanations by the teachers will alternate with the raising of questions and discussion among the students. To complement them, personal study of the topics worked on is necessary.

Problem classes, exercises and seminars:
In these sessions, with a double mission, on the one hand, the scientific-technical concepts previously worked on in the theoretical classes are worked on to complete their understanding and delve into them basically based on the resolution of problems. On the other hand, based on the critical discussion of the exercises carried out, these classes are the natural forum in which to discuss together the development of the work done by the students, providing the necessary knowledge to carry it forward, or indicating where and how it can be acquired. The mission of the problem classes and seminars is to act as a bridge between the theoretical classes and independent work, promoting the capacity for analysis and synthesis, critical reasoning, and the capacity for problem resolution.

Note: 15 minutes of a class will be reserved, within the calendar established by the center/degree, for students to complete the surveys to evaluate the performance of the teaching staff and to evaluate the subject/module.

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
Sesiones de teoría y problemas	100%	10	0.4	CM07, CM08, KM06, KM07, KM08, SM04, SM05, SM06

This subject will be subject to continuous assessment. The final grade will be distributed among the following concepts:

- Follow-up evidences (15% weight, non-retrievable)
- 2 Midterm Exams (P1 and P2, 85% weight altogether)

To pass the subject, the weighted average of the two midterm exams and the follow-up evidences (short individual tests to be taken on seminar days) will be taken and the grade obtained must be at least 5.0. In addition, a minimum of 4.0 is required in each of the two midterms P1 and P2.

- Final retake exam (85% weight). Optional and includes all the subject material, with the aim of retaking the subject or raising the final grade of the subject. The grade of the final exam will replace the grade that could have been obtained from the two midterms together. It should be noted that only 85% of the subject can be retaken, corresponding to the grade of the midterm exams. The grade for the follow-up evidences (15% weight) cannot be recovered. To take the final exam, students must have previously taken at least 1 of the 2 partial exams.

Those not assessed
Students will be considered to obtain the grade of "Not assessable" if they have not taken all the partial exams or the final exam.

SINGLE EVALUATION
Students who have taken advantage of the single evaluation modality must take a final global test for the subject that will be held on the same day, time and place as the test for the second partial of the continuous evaluation modality. The final grade for the subject will be the one obtained from this final test since the continuous evaluation evidences will not have been taken.
If the grade is lower than 5.0 out of 10, the student will have another opportunity to pass the subject through the retake exam that will be held on the date set by the degree coordination (same day as the retake exam for students whofollow continuous assessment).

Bibliography

- Estructura atómica y enlace químico. J. Casabó. Ed. Reverté (1996). ISBN: 9788429171150.

- Principios de Química: los caminos del descubrimiento. Atkins & Jones. Ed. Médica Panamericana. 5ª ed. (2012). ISBN: 9789500602822

- R.H. Petrucci, F.G. Herring, J.D. Madura y C. Bissonette. Química general. Principios y aplicaciones modernas. Pearson Educación. 11ª ed. (2017). Available on line as en ebook at Biblioteques UAB: https://www-ingebook-com.eu1.proxy.openathens.net/ib/NPcd/IB_Escritorio_Visualizar?cod_primaria=1000193&l ISBN: 9788490355336, ISBN ebook: 9788490355343

- Petrucci's General Chemistry: Principles and Modern Applications - Ebook (2023) 12th edition. ISBN-13: 9781292726137. Available on line as en ebook at Biblioteques UAB: https://research.ebsco.com/c/c5g535/search/details/3kvmbrvefr?db=nlebk ISBN-13: 9781292726168

Software

This subject does not use any particular software.

Groups and Languages

Please note that this information is provisional until 30 November 2025. You can check it through this link. To consult the language you will need to enter the CODE of the subject.

Name	Group	Language	Semester	Turn
(PAUL) Classroom practices	1	Catalan/Spanish	first semester	morning-mixed

(PAUL) Classroom practices	2	Catalan/Spanish	first semester	morning-mixed
(SEM) Seminars	11	Catalan/Spanish	first semester	morning-mixed
(SEM) Seminars	12	Catalan/Spanish	first semester	morning-mixed
(SEM) Seminars	21	Catalan/Spanish	first semester	morning-mixed
(SEM) Seminars	22	Catalan/Spanish	first semester	morning-mixed
(TE) Theory	1	Catalan/Spanish	first semester	morning-mixed
(TE) Theory	2	Catalan/Spanish	first semester	morning-mixed