Universitat Autònoma de Barcelona

2023/2024

Chemistry of the Earth

Code: 101060
ECTS Credits: 10

Degree	Type	Year	Semester
2500254 Geology	FB	1	A

Contact

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Teaching groups languages

You can check it through this link. To consult the language you will need to enter the CODE of the subject.
Please note that this information is provisional until 30 November 2023.

Teachers

Gumersinda Galan Garcia

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Prerequisites

This subject does not have official prerequisites, but students must know the fundamental concepts corresponding to the subjects of Baccalaureate Chemistry: formulation, stoichiometry, atomic structure and bond, thermodynamics and ionic equilibria (acid-base, precipitation and redox).

The Universitat Autònoma de Barcelona offers a propedéutic chemistry course for those students who consider that they have not achieved these concepts. This intensive course provides the student with a review of the fundamental concepts for a good follow-up of this subject.
The secretary of the Faculty of Sciences has information (enrollment, dates, etc ...) on this propedéutico course.

Objectives and Contextualisation

"Química de la Terra" in the degree:
This is a first-cycle subject, basic training, which develops the foundations of chemistry at a theoretical, practical and laboratory level. This subject gives tools and knowledge to be used in other subjects of the Degree in Geology.

Training objectives:
The objective of this subject is that the student is able to master the following topics:
1) The atoms, the elements, the periodic table.
2) Important elements in geology and isotopes.
3) Introduction to chemical thermodynamics and kinetic.
4) Introduction to chemical thermodynamics and kinetic.
5) Chemical bonding and bonding in solids.
6) Balance in aqueous solution: acid-base, dissolution-precipitation reactions and oxidation-reduction equilibrium.
7) Chemical Kinetics.
8) Geological origin of the main ones

Competences

- Learn and apply the knowledge acquired, and use it to solve problems.
- Show an interest in quality and incorporate it into practice.
- Suitably transmit information, verbally, graphically and in writing, using modern information and communication technologies.
- Use chemistry concepts when solving problems in geology.
- Work independently.

Learning Outcomes

1. Learn and apply the knowledge acquired, and use it to solve problems.
2. Show an interest in quality and incorporate it into practice.
3. Suitably transmit information, verbally, graphically and in writing, using modern information and communication technologies.
4. Use and discern the basics of chemistry in order to understand geology.
5. Work independently.

Content

Block I

1. Atomic structure
Historical background. First atomic models. Waves and particles. Electromagnetic radiation. The hydrogen atom: Bohr's atomic model. Quantum mechanics. Hydrogen atomic orbital: quantum numbers. Representation of orbitals. Electronic spin. Polyelectronic atoms: atomic orbitals and energy levels. Electron shielding and effective nuclear charge. Pauli exclusion principle. Electronic configuration: Aufbau rule.

2. The periodic table
Ordering of elements according to atomic number. Classification of elements into groups, periods and blocks. Periodic properties of atoms. Atomic radius and ionic radius. Ionization potential. Electronic affinity. Electronegativity.

3. Chemical bond (I)
Aggregation states and discrete molecules. Type of link. Structural and energy parameters. Polarity of the bond and dipole moment. Covalent bond: Lewis structures. Concepts of resonance, bond order, formal charge and oxidation state. Molecular geometry: theory of electron pair repulsion (VSEPR).

4. Chemical bond (II)
Types of solids. Crystalline structures. Ionic solids. Reticular energy: Born-Haber cycle. Covalent solids and molecular solids. Metallic link. Intermolecular forces: hydrogen bonding and van der Waals forces.

5. Chemical Kinetics
Inorganic formulation. Chemical reactions: stoichiometry. Chemical equilibrium. Reaction rate. Elemental reactions and molecularity. Reaction order. Speed constant. Arrhenius equation. Integrated velocity equations.

Block II

6. Thermochemistry
Introduction.- Heat and work.- Reversible and irreversible processes.- First Principle. Internal energy.- Enthalpy.- Applications.- Thermochemistry.- Enthalpy of standard formation and enthalpy of standard reaction.- Hess's law.- Kirchoff's law.- The problem of energy: fuels.
Reversibility and spontaneity.- Second Principle. Entropy.- Applications.- Gibbs and Helmholtz energies.- Spontaneity and equilibrium criteria.- Third Principle.

7. Solutions
Introduction.- Clapeyron and Clausius-Clapeyron equations.- Ideal solutions. Raoult's law.- Diluted solutions. Henry's law.- Collective properties.

Block III

8. Phase balance and phase rule (I)
Concept of phase, component, degree of freedom. Phase balance. Phase rule. Graphic representation of chemical composition (chemography).

9. Phase balance and phase rule (II)
Phase diagrams as a graphical expression of phase rules. Unary systems. Binary systems.

Block IV

10. Chemical equilibrium
Concept of chemical equilibrium. Equilibrium constant: Kp and Kc. Influence of temperature: van't Hoff equation. Displacement of equilibrium: Le Chatelier's principle.

11. Acids and bases (I)
Acid-base theories. Self-ionization of water and pH scale. Strong acids and bases. Weak acids and bases.

12. Acids and bases (II)
Polyprotic acids and bases. Ions as acids and bases: hydrolysis and pH of salts. Problems of mixing acids and bases. Buffer solutions. Acid-base titrations.

13. Solubility and complexation equilibria
Solubility and solubility product Kps. Common ion effect. Solubility and pH. Complexation equilibria.

14. Electrochemistry
Concept of oxidation and reduction. Equalization of redox reactions. Electrode potential and standard electrode potential.- Electromotive force. Nernst equation. Batteries. Corrosion. Electrolysis.

Methodology

The center of the learning process is the work of the student. The student learns working, being the mission of the teaching staff to help him / her in this task (1) providing information or showing the sources where it can be obtained and (2) directing his / her steps so that the learning process can be done 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:

1) Expositive classes (theory)
The student acquires the scientific-technical knowledge of the course by attending lectures and complementing them with the personal study of the topics explained. These classes are the activities in which less student interactivity is required: they are conceived as a fundamentally unidirectional method of transmitting knowledge from the teacher to the student.

2) Classes of problems and seminars
The classes of problems and seminars are sessions with a small number of students. The scientific knowledge is worked on by solving problems and / or practical cases. In these classes there must be a strong interaction between students and teachers in order to complete and deepen the understanding of the knowledge worked in the theoretical classes.

In the seminar classes the student works individually or in a group solving exercises and / or questions raised in the same class or previously. The sessions of problems and seminars should also serve as a solution to doubts and deepen certain key concepts of the subject.

Some of these activities will count for the continuous evaluation note.

3) Laboratory practices
Practices were carried out during the course in the chemistry laboratories. There will be two sessions, of 4 hours each.

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.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Classes of problems	24	0.96	1, 2, 5, 4
Expositive classes (theory)	51	2.04	1, 2, 4
Laboratory Practices	8	0.32	1, 2, 3, 5, 4
Seminars	2	0.08	1, 2, 5, 4
Type: Autonomous			
Preparation of Work and Study	146	5.84	1, 2, 3, 5, 4

Assessment

CONTINUOUS EVALUATION

The evaluation of the subject will be carried out through the following activities:

a. Written tests (exams)

b. Evidence of learning

c. Laboratory practices

a. Written tests (exams)

- During the first semester there will be two partial exams of the subject that will collect topics 1 to 7 (block I and block II)

- During the second semester there will be two partial exams of the subject that will collect topics 8 to 14 (block III and block IV)

- At the end of the course (June/July) there is a recovery exam for the first semester (block I + block II) and the second semester (block III and block IV).

b. Evidence of learning

They are individual or group activities (inside or outside the classroom) to work on various aspects of the contents of the subject.

c. Laboratory practices

Attendance at laboratory practices is MANDATORY. Not attending without justification will prevent passing the subject.

In case of not justifiably attending any of the practice sessions, and not having the option of doing it in a group other than the one assigned, this session will not be considered in the calculation of the practice grade. The justification will require the presentation of medical proof or equivalent (overlap with other subjects, trips, work is not valid ...).

Evaluation. Laboratory reports will be evaluated and attitude and work in the laboratory will also be taken into account (NPLab).

First semester grade (N1s)

They will evaluate topics 1 to 7 with the following weighting:

- Note block I: the examination of topics 1-5 will have a weight of 70% and the learning evidences of topics 1-5 a weight of 30%.

- Note block II: the examination of topics 6-7 will have a weight of 70% and the learning evidence of topics 6-7 a weight of 30%.

- The grade of the first semester is obtained: N1s = (Note block I) x 0.65 + (Note block II) x 0.35

- If the GRADE OF THE FIRST SEMESTER (N1s) is less than 3.5 the student must take the recovery exam of topics 1 to 7.

Second semester grade (N2s)

They will evaluate topics 8 to 14 with the following weighting:

- Note block III: the examination of topics 8-9 will have a weight of 70% and the learning evidence of topics 8-9 a weight of 30%.

- Note block IV: the examination of topics 10-14 will have a weight of 70% and the learning evidence of topics 10-14 a weight of 30%.

- The grade of the second semester is obtained: N2s = (Note block III) x 0.35 + (Note block IV) x 0.65

- If the GRADE OF THE FIRST SEMESTER (N2s) is less than 3.5 the student must take the recovery exam of topics 8 to 14.

Final note of the assignatura (NF)

To participate in the recovery students must have been previously evaluated in a set of activities whose weight equals to a minimum of 2/3 of the total grade of the subject.

- The final grade is obtained from the following weighting: NF = (N1s x 0.45) + (N2s x 0.45) + (NPLab x 0.10)

- You must havea minimum of 5.0 in the final grade (NF) to pass the subject.

Improvement of the grade (in the recovery exam):

Students who have passed the subject per course but who want to improve their grade under the following conditions may take the recovery exam for one semester (or both):

1) If the student improves the grade, the best grade will be used.

2) If the student does not improve the grade, the average of the two grades will be made.

Evaluation as "Not Evaluated"

A student will be considered "Not evaluated" if the weight of the evaluation activities carried out is less than 30% of the total of those programmed in the subject.

UNIQUE AVALUATION

Within the regulatory period established by the University, students may request the single evaluation, renouncing the continuous evaluation.

Laboratory practices are left out of the single assessment.

The evaluation of the subject will be carried out through the following activities:

a. Written tests (exams)

b. Learning evidence (may be required in some block)

c. Laboratory practices

a. Written tests

The single evaluation will consist of ONE SINGLE synthesis test, which will be carried out at the end of the course, and which will have two parts:

- Part 1. An examination of the syllabus of the 1st semester (blocks I and II: topics 1 to 7). Weighting: 65% block I and35% block II. Minimum grade to pass: 3.5 points (out of 10)

- Part 2. An examination of the 2nd semester syllabus (blocks III and IV: topics 8 to 14). Weighting: 35% block III and 65% block IV. Minimum grade to pass: 3.5 points (out of 10)

b. Evidence of learning

In any of the four blocks, the realization of learning evidence can be required. They will have to be delivered on the day of the "synsthesis test".

- If evidence of learning is requested in a blog. The grade of the block will be the weighting of the exam grade (70%) and the evidence grade (30%).

- The grade of a block will be the grade of the exam (100%), if in that block no evidence is required.

c. Laboratory practices

They are mandatory and are outside the single assessment.

The student must do them on the dates set by the Faculty, and will be evaluated in the same practice sessions.

In case of not justifiably attending any of the practice sessions, and not having the option of doing it in a group other than the one assigned, this session will not be considered in the calculation of the practice grade.

The justification will require the presentation of medical proof or equivalent (overlap with other subjects, trips, work is not valid ...).

Evaluation. Laboratory reports will be evaluated and attitude and work in the laboratory will also be taken into account (NPLab).

First semester grade (N1s)

- The grade of the first semester is obtained: N1s = (Note block I) x 0.65 + (Note block II) x 0.35

Second semester grade (N2s)

- The grade of the second semester is obtained: N2s = (Note block III) x 0.35 + (Note block IV) x 0.65

Final grade of the subject (NF)

- The final grade of the subject will be the weighted average of the syllabus of the 1st semester (45%), of the syllabus of the 2nd semester (45%) and of the laboratory practices (10%).

  NF = (N1s x 0.45) + (N2s x 0.45) + (NPLab x 0.10)

- It will be necessary to obtain a minimum of 5.0 to pass the subject.

Improvement of the grade (in the recovery exam):

Students who have passed the subject by course but who want to improve their grade under the following conditions may take the recovery exam for the entire course (all syllabus):

1) If the student improves the grade, the best grade will be used.

2) If the student does not improve the grade, the average of the two grades will be made.

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
First Partial Exam	33,5%	2	0.08	1, 2, 5, 4
Laboratory Practices	10%	8	0.32	1, 2, 3, 5, 4
Learning evidences	27%	4	0.16	1, 2, 3, 5, 4
Recovery exam	63%	3	0.12	1, 2, 3, 5, 4

Second Partial Exam	31,5%	2	0.08	1, 2, 5, 4

Bibliography

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Software

There is not.