Environmental Geochemistry

Code: 101068
ECTS Credits: 6

2025/2026

Degree	Type	Year
Geology	OT	3
Geology	OT	4

Contact

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Teachers

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Teaching groups languages

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

Prerequisites

Students are recommended to have acquired the basic skills of the Geochemistry lessons.

Objectives and Contextualisation

- To learn about the main physical and chemical processes that regulate the distribution and mobility of pollutants.

- To provide tools for identifying and interpreting environmental problems.

- To learn about strategies for remedying environmental problems.

- To develop and evaluate possible solutions to environmental problems involving geochemistry.

- To learn about possible job opportunities related to environmental geochemistry.

Competences

Geology
- Display knowledge of the applications and limitations of geophysical methods for learning about the Earth.
- Display understanding of the size of the space and time dimensions of Earth processes, on different scales.
- Evaluate moral and ethical problems in research and acknowledge the need to follow professional codes of conduct.
- Identify and tackle environmental problems, plan land-use and know the principles of prevention and mitigation of geological risks.
- Process, interpret and present field data using qualitative and quantitative techniques, and suitable computer programmes.
- Process, interpret and present laboratory data using qualitative and quantitative techniques, and suitable computer programmes.

Learning Outcomes

1. Apply Geochemistry concepts to solve problems of land and water pollution.
2. Assess changes to geological environments and their level of degradation resulting from direct anthropogenic action or climate change.
3. Describe, analyse, evaluate, plan and manage the physical environment and the geological heritage.
4. Evaluate and process laboratory data corresponding to environmental issues.
5. Identify and process the value and the sources of field data with environmental implications.
6. Interpret relief dynamics on different time-space scales in terms of risk and land-use planning.
7. Plan the successive exploration stages for each type of project and the development stages from the perspective of sustainability, to avoid irreparable losses of resources and/or geological heritage.
8. Synthesise and select field data and process it qualitatively and quantitatively using different computer programmes.
9. Undertake professional activity in the field of environmental geology, complying with moral and ethical principles.
10. Use low-temperature geochemistry to identify environmental problems.

Content

Theory:

1. Mineralogy and geochemistry of pollutants: Types and characteristics of pollutants. Organic pollutants. Inorganic pollutants. Mobility and disposal of pollutants in the exogenous cycle.

2. Atmospheric pollution: Composition and structure of the atmosphere. Energy transfer in the atmosphere. Selective absorbing gases and the greenhouse effect. Chemical and photochemical reactions in the atmosphere. Urban atmosphere. Atmospheric particles.

3. Soil pollution: Physicochemical properties of soils. Origin of soil pollution. Factors influencing soil pollution. Different examples of soil pollution. Techniques for remediating contaminated soils.

4. Water pollution: Basic concepts of hydrochemistry. Water quality. Water use and management. Surface and groundwater pollution- Prevention, measurement, control and remediation of polluted water.

5. Isotopes of pollutants. Basic concepts. Radioactive isotopes. Stable isotopes. Environmental isotopes and their applications in pollution studies. Examples.

6. Sampling techniques in environmental geochemistry. Applications in the atmosphere, soil and water. Sampling strategies.

Project-based exercises and practical work

Geochemistry problems relating to cases of pollution in the atmosphere, soil and water.

Project-based practical work.

During the project-based practical work, a real study will be carried out in an environment contaminated by compounds dissolved in water. In this environment, there are two entities that can cause pollution. Working in groups, students will have to determine what is responsible for the pollution based on geochemical data. The following aspects will be covered during the project:

1. Hydrogeological and geological contextualisation of the case study.

2. Sampling decisions

3. Processing and interpretation of hydrochemical data I: ionic balance, analytical quality, classification of waters in the Piper diagram using Excel spreadsheets.

4. Hydrochemical modelling I: speciation using Phreeqc software.

5. Hydrochemical modelling II: saturation index using Phreeqc software.

6. Isotopic data processing and interpretation I: calculation of the local meteoric line and evaporation line.

7. Isotopic data processing and interpretation II: calculation of the mixing line and quantification of contamination

8. Joint discussion of all data and project closure.

Seminar

Workshop practical case studies

Activities and Methodology

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Master classes	26	1.04	10, 1, 9, 2, 6, 3
Practices / Problems / Exercises	15	0.6	10, 7, 5, 6, 8
Seminars	10	0.4	1, 9, 2
Type: Autonomous			
Study of topics and carrying out exercises using specific programs and the recommended bibliography.	81	3.24	10, 7, 1, 9, 6, 3, 8

Master lectures.

By attending lectures, students acquire the scientific knowledge specific to the subject, which they will then have to supplement by studying the topics covered.

Exercises and practical work in the classroom.

The exercises will cover environmental geochemistry problems focused on pollutants. The practical work will analyse real cases in which students will have to evaluate and solve environmental problems. Real cases will be analysed.

Seminars

These are sessions that reinforce the theoretical and practical aspects taught in the master lectures, allowing students to work on theoretical aspects through their application to specific cases.

Note: 15 minutes of each class, within the schedule established by the faculty/degree program, will be reserved for students to complete the teacher performance evaluation and course/module evaluation surveys.

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
Delivery of a paper on an assigned topic.	15	4	0.16	7, 2, 4, 6
Partial theoretical and practical exams and final exam	70	8	0.32	10, 7, 1, 9, 2, 5, 4, 6, 3, 8
Practices / Problems / Exercises to be delivered	15	6	0.24	10, 7, 5, 8

Assessment

In this course, theoretical and practical skills and abilities will be assessed through CONTINUOUS ASSESSMENT (CA) according to the following guidelines:

EXAMS: The partial exams with a score lower than 3 must be recovered in the final exam.

PRACTICAL GROUP WORK:

Theoretical-practical exams and final recovery exams: 70% of the score: 2 partial theoretical-practical exams (35% each).

A minimum score of 3 must be obtained in each partial exam to obtain an AC score.

PROBLEMS AND GROUP PRACTICAL WORK

The submission of problems/exercises will be required: up to 5% of the score.

You will have to submit a group assignment: 25% of the score. The assignment must be submitted in electronic format. The assignment must comply with the rules (script, format) specified by the teachers, in particular the rules for proper accreditation of all material used. If the source of all material used is not clearly indicated, the assignment will automatically receive a grade of 0 points.

CONTINUOUS ASSESSMENT SCORE (CA):

The final CA score will be calculated as follows:

Score of the 1st partial exam x 0.35 + score of the 2nd partial exam x 0.35 + score of the practical work x 0.25 + score of the problems/exercises x 0.05.

The AC score will only be calculated if the grade for both partial exams is equal to or higher than 3.

RECOVERY:

If the CA is not passed (score in each partial exam < 3 or CA grade < 5 points), the student will have to take the final recovery exam (PF). She/he may take a recovery exam/improvement exam for the first partial exam, the second partial exam, or both.

There will not be a recovery/2nd call for re-submission of the practical work and exercises/problems. The score obtained in the continuous assessment phase will be final.

Students who have passed the CA may also take either of the two parts of the FA to improve their final score.

Score of the 1st part x 0.35 + Score of the 2nd part x 0.35 + Score of the work x 0.25 + Score of the problems/exercises x 0.05 (with the particularities indicated above).In this calculation, the best score obtained in each of the mid-term exams will always be considered.

SINGLE ASSESSMENT (SA):

Final synthesis test covering all course content, similar to the sum of the topics covered in the 1st and 2nd partial AC exams.

It will be take place on the same date as the second continuous assessment midterm exam. On this date, after completing the exam, students will have to submit the same exercises, assignments or dossiers that have been established as compulsory for students enrolled in the CA mode. A score of 5 or higher must be obtained to pass the test.

FINAL SCORE FOR SINGLE ASSESSMENT (SA):

Exam score 0.70 + Work project score x 0.25 + Problems/exercises score x 0.05

RECOVERY OF SINGLE ASSESSMENT (RAU):

Final synthesis test in which all the contents of the subject can be included, like the sum of those of the 1st + 2nd partial exams of the CA. It will take place on the same day as the CA recovery:

Not assessable

If the student has only been assessed on a maximum of 33% of the tests and drops out, the final grade will be NOT ASSESSABLE.

Use of AI

In this course, the use of Artificial Intelligence (AI) technologies is not permitted at any stage. Any work that includes fragments generated by AI will be considered academic dishonesty and may result in a partial or total penalty on the activity grade, or greater penalties in serious cases.

Bibliography

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Appelo, C.A.J., and Postma, D., 2005. Geochemistry, Groundwater and Pollution (2nd ed.). CRC Press, 536 pp.

De Vivo B., Belkin., Lima A., 2008. Environmental geochemistry: site characterization, data analysis and case histories. Elsevier, 429 pp.

Eby, N. G., 2003. Principles of Environmental Geochemistry. Academic Press, Amsterdam, 514 pp.

Harrison, R. M., 2004. El medio ambiente. Introducción a la química mediambiental y a la contaminación. Acribia, Editorial, S.A., Zaragoza, 490 pp.

Walter, J.V., 2005. Essentials of geochemistry. Jones and Bartlett Publishers, Boston, 704 pp.

Zhou, C., and Anderson, G., 2002. Environmental Applications of Geochemical Modeling. Cambridge University Press, 284 pp.

Software

No specific software is required.

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
(PLAB) Practical laboratories	1	Catalan	first semester	morning-mixed
(SEM) Seminars	1	Catalan	first semester	morning-mixed
(TE) Theory	1	Catalan	first semester	morning-mixed