UAB
Universitat Autònoma de Barcelona

Environmental Geochemistry

2026/2027

Code: 101068
Credits: 6

Degree programme	Type	Course
Geology	OP	3

Contact lecturer

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Group languages

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

Prerequisites

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

Objectives

- To understand the main physicochemical processes that regulate the distribution and mobility of pollutants.

- To provide tools for identifying and interpreting environmental problems.

- To understand the remediation strategies for environmental problems.

- To develop and evaluate potential solutions for environmental problems involving geochemistry.

- To understand potential career paths related to environmental geochemistry.

Learning outcomes

- CM39 (Design studies on the availability of hydrogeological resources based on future models on variation in rainfall due to climate change.) Design studies on the availability of hydrogeological resources based on future models on variation in rainfall due to climate change.
- CM40 (Evaluate areas of geological risk for the planning and environmental and urban management of the territory, contributing to a sustainable and safe management of the environment.) Evaluate areas of geological risk for the planning and environmental and urban management of the territory, contributing to a sustainable and safe management of the environment.
- KM46 (Identify the extent of different disciplines of geology that are related to environmental sciences.) Identify the extent of different disciplines of geology that are related to environmental sciences.
- KM49 (Explain the main concepts and techniques related to protecting, preventing and mitigating contamination in reservoirs and soils.) Explain the main concepts and techniques related to protecting, preventing and mitigating contamination in reservoirs and soils.
- SM44 (Use specific instruments designed to assess the environmental geological risk of a specific place following the established protocols.) Use specific instruments designed to assess the environmental geological risk of a specific place following the established protocols.
- SM45 (Participate in the resolution of problems related to the environmental impact of actions in the field of geology.) Participate in the resolution of problems related to the environmental impact of actions in the field of geology.

Contents

Theory:

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

2. Sampling techniques in environmental geochemistry. Application in the atmosphere, soils and waters. Sampling strategies.

3. Isotopy of pollutants: Basic concepts. Radioactive isotopes. Stable isotopes. Environmental isotopes and their applications in pollution studies. Examples.

4. 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.

5. Soil pollution: Physico-chemical properties of soils. Origin of soil pollution. Factors influencing soil pollution. Different examples of soil pollution. Remediation techniques for contaminated soils.

6. Water pollution: Basic concepts of hydrochemistry. Water quality. Water uses and management. Surface and groundwater pollution. Prevention, measurement, control and remediation of contaminated water.

Project-based exercises and practical exercises:

Geochemical problems on cases of atmospheric, soil and water pollution.

Project-based practical work. The aim of the project is to encourage participatory teaching, promoting the scientific method and critical thinking.

During the development of the project-based practical work, a real-world study will be conducted in an environment contaminated by dissolved compounds in water. In this environment, there are two entities that could be responsible for the contamination. In groups, students will have to determine the cause of the contamination based on geochemical data. The following aspects will be covered during the project:

1. Hydrogeological and geological context of the case study.

2. Sampling decision.

3. Hydrochemical data processing and interpretation I: ionic balance, analytical quality, water classification on a Piper diagram using Excel software.

4. Hydrochemical modelling I: speciation using the Phreeqc software.

5. Hydrogeochemical modelling II: saturation index using the 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 mixing lines and quantification of contamination.

8. Joint discussion of all data and project closure.

Seminar (dedicated to the following item or other related ones):

Study of real cases.

Learning activities and methodology

Title	Hours	ECTS	Learning outcomes
Practices / Problems / Exercises	15	0.6	SM44, SM45
Master classes	26	1.04	CM39, CM40, KM46, KM49
Study of topics and carrying out exercises using specific programs and the recommended bibliography.	81	3.24	SM44, SM45
Seminars	10	0.4	KM46, KM49

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

Continuous assessment activities

Title	Weight	Hours	ECTS	Learning outcomes
Practices / Problems / Exercises to be delivered	15	6	0.24	KM46, KM49, SM44, SM45
Delivery of a paper on an assigned topic.	15	4	0.16	SM44, SM45
Partial theoretical and practical exams and final exam	70	8	0.32	CM39, CM40, KM46, KM49, SM44, SM45

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 ARTIFICIAL INTELLIGENCE

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

Aelion, M., Höhener, P., Hunkeler, D., Aravena, R., 2010. Environmental isotopes in Biodegradation and Bioremediation. Taylor and Francies Group, 437 pp.

Albarède, F., 1995. Introduction to Geochemical Modelling. Cambridge University Press, Cambridge, 543 pp.

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

Baskaran, M., 2011. Handbook of Environmental Isotope Geochemistry. Springer, 951 pp.

Berkowits, B., Dror, I., Yaron, B., 2014. Contaminant Geochemistry. Interactions and transport in the subsurface environment (2nd ed.). Springer, 582 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.

Course groups and languages

The information provided is provisional until November 30. After this date, you will be able to consult the language of each group through this link. To access the information, you will need to enter the course CODE

Type of teaching	Group	Language	Semester	Shift
(TE) Theory	1	Catalan	first semester	morning-mixed
(PLAB) Practical laboratories	1	Catalan	first semester	morning-mixed
(SEM) Seminars	1	Catalan	first semester	morning-mixed