

26420 - Geochemistry

Información del Plan Docente

Academic Year	2018/19
Subject	26420 - Geochemistry
Faculty / School	100 - Facultad de Ciencias
Degree	296 - Degree in Geology
ECTS	7.0
Year	3
Semester	First semester
Subject Type	Compulsory
Module	---

1.General information

1.1.Aims of the course

1.2.Context and importance of this course in the degree

1.3.Recommendations to take this course

2.Learning goals

2.1.Competences

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The methodology followed in this course is oriented towards the achievement of the learning objectives. A wide range of teaching and learning tasks are implemented, such as lectures, practice sessions and assessment tasks.

This course is designed to provide a broad introduction to Geochemistry by presenting the key geochemical concepts and methods needed to solve geological problems.

The student will develop competences in the application of the basic principles of chemistry to the Earth, including factors controlling the abundance and distribution of chemical elements in the Earth and the Solar system, the behaviour of elements during geological processes, and geochemical methodologies to solve geological problems.

4.2. Learning tasks

This course is organized as follows:

- **Lectures** (2.5 ECTS: 25 hours). One-hour sessions
- **Practice sessions** (4.5 ECTS): organised into two-hour sessions
- **Assessment tasks**
 - o Essay. An optional paper on an issue related with the topics included in the lectures or practice sessions.
 - o Exams: Each part is examined individually. 5 out of 10 points are required for passing each exam. Exercises of the practice sessions are considered for the final mark of the course.

4.3. Syllabus

This course will address the following topics:

Lectures

Section 1: Fundamentals

- **Topic 1:** Introduction to Geochemistry.

Section 2: Chemical elements in the Solar System and in the Earth

- **Topic 2:** Cosmochemistry and meteorites.
- **Topic 3:** Geochemistry of the solid earth: the mantle and the core.
- **Topic 4:** Geochemistry of the solid earth: the crust.
- **Topic 5:** The atmosphere.
- **Topic 6:** The hydrosphere.

Section 3

- **Topic 7:** Properties of the chemical elements.
- **Topic 8:** Applications of thermodynamics to the Earth.
- **Topic 9:** Kinetics
- **Topic 10:** Trace elements in igneous processes.
- **Balances de masas. Procesos de fusión y cristalización. Refinamiento por zonas. Procesos en sistemas abiertos.**
- **Topic 11.** Geochronology: fundamentals and geological applications.
- **Topic 12.** Radiogenic isotope geochemistry.
- **Topic 13.** Stable isotope geochemistry (I).
- **Topic 14.** Stable isotope geochemistry (II).

Section 4: Using of major and trace element in geological processes

- **Topic 15.** Classification of elements according to their geochemical behaviour.
- **Topic 16.** Using discrimination geochemical diagrams.
- **Topic 17.** Mineral chemistry.

Section 5: Geochemistry of exogenous processes

- **Topic 18.** Geochemistry of carbonates.
- **Topic 19.** Geochemistry of terrigenous rocks.

Section 6: Geochemical exploration.

- **Topic 20.** Fundamentals of geochemical exploration (I)

26420 - Geochemistry

- **Topic 21.** Fundamentals of geochemical exploration (II)

Practice sessions

- Session 1. Meteorites.
- Session 2. Analysing geochemical data.
- Session 3. Relationship between modal and geochemical compositions.
- Session 4. Mineral composition of basic igneous rocks.
- Session 5. Mineral composition of intermediate igneous rocks.
- Session 6. Geochemical composition of accessory minerals.
- Session 7. Geochemistry of granitic rocks.
- Session 8. Analytical methods in hydrogeochemistry
- Session 9. ICP-MS
- Session 10. Electron probe microanalysis.
- Session 11. LA-ICP-MS.
- Session 12. Mass spectrometry.
- Session 13. Isochron calculations: Rb-Sr and Sm-Nd systems.
- Session 14. Pb-Pb ages in zircon.
- Session 15. Stable isotopes in carbonate rocks.
- Session 16. Using stable isotopes in paleoclimatic reconstructions.
- Session 17. Using stable isotopes in paleoenvironmental reconstructions.
- Session 18. Geochemistry of terrigenous rocks.
- Session 19. Ar39 / Ar40 radiometric ages.
- Session 20. Using of cosmogenic isotopes in geological processes.
- Session 21. Design and development of a research project.
- Session 22. Final session: evaluation.

4.4. Course planning and calendar

- Exams: see official exams calendar for dates and places of exams (<https://ciencias.unizar.es/consultar-examenes>).
- Theory and practice sessions will follow the official schedule published by the Science Faculty. (<https://ciencias.unizar.es/calendario-y-horarios>)
- Office hours: Monday, Wednesday and Thursday (9,0-11,00 am); Science Faculty, Building C, First floor, Office 41. Available by appointment (marceliano64@gmail.com).

Further information concerning the timetable, classroom, office hours, assessment dates and other details regarding this course will be provided on the first day of class or please refer to the Faculty of Sciences and Earth Sciences Department websites (<https://ciencias.unizar.es>, <https://cienciatierra.unizar.es>) and Moodle.

4.5. Bibliography and recommended resources

Course materials will consist of class notes, lecture notes (pdf files of Powerpoint presentations will be provided) and handouts. Recommended textbooks are:

- Faure, G. (1998). Principles and applications of geochemistry. Prentice Hall, 2nd edition.
- Faure, G. (1986). Principles of isotope geology. John Wiley & Sons, 2nd edition.
- Drever, J.I. (1997). The geochemistry of natural waters. Prentice Hall, 3rd edition.
- Levinson, A. A (1974). Introduction to exploration geochemistry. Applied Publishing. Wilmette, Illinois.
- Albarède, F. (2009). Geochemistry: an introduction. Cambridge University Press, 2nd edition.

In addition, the following books might be useful:

- Richardson, S.M. and McSween Jr., H.Y. (1989). Geochemistry: pathways and processes. Prentice Hall.
- Hoefs, J. (2004). Stable isotope geochemistry. Springer-Verlag, Berlin, 5th edition.

26420 - Geochemistry

- Rollinson, H. (2007). Early Earth systems: a geochemical approach. Blackwell Publishing