

Geochemistry

ERTH 2106 (Winter 2026)

Carleton University is located on the unceded territory of the Algonquin Anishinaabe Nation. We acknowledge the Algonquin people as the traditional custodians of this land and recognize their enduring relationship with the Earth and its resources.

Instructor: Hanika Rizo (she/her)

E-mail: hanika.rizo@carleton.ca

Office location: HP 2221

Note: If you have questions or would like to talk, you are welcome to stay after lecture. You may also contact me by email to arrange an in-person or virtual meeting.

Lectures: In-person, room 3120 HP.

1.5 h/week, Monday 11:35 am - 12:55 pm.

First class January 5, 2026.

Labs: In-person, room 3120 HP.

3h/week, Tuesday 8:35 am -11:25 am or

Wednesday 2:35 pm - 5:25 pm

First lab week of January 5, 2026.

Prerequisites: ERTH 1002 (The Earth and Life Odyssey: A Journey Through Billions of Years), CHEM 1001, CHEM 1002.

Course TAs:

Colleen Harper

ColleenHarper@cmail.carleton.ca

Patrick Fraser

PatrickMFraser@cmail.carleton.ca

Student Hours: TBD. are scheduled times throughout the week when you can connect with the TA. You are welcome to drop in to introduce yourself, ask questions about the course, or discuss any course-related topics.

Welcome to this Course!

This course explores geochemical processes from deep Earth to surface environments, and the use of geochemical pathways to better understand the Earth's history.

Learning outcomes

By the end of the course, students will be able to:

- Explain how major and trace elements behave and are distributed across a range of geological environments (e.g., mantle, crust, hydrosphere).
- Evaluate leading models for Earth's differentiation into core, mantle, and crust, and describe current hypotheses for the origin of the oceans and atmosphere.
- Identify and describe the principles underlying common geochronological methods and recognize the types of geological questions to which these methods can be applied.
- Apply fundamental concepts of trace element fractionation to interpret simple geochemical datasets and to infer geological and environmental processes.

Inclusive Learning Statement

I am committed to creating an inclusive learning environment and continually reflecting on my teaching practices. I welcome your feedback and invite you to share your preferred name and pronouns by email or in person.

Topics Covered (tentative order; might change during the semester)

Attendance to lectures is essential for the success in the course, as they introduce the material required for labs and exams. All labs are mandatory.

Week	Lectures	Labs
January 5	Intro to geochemistry, properties of elements, the periodic table	Lab #1
January 12	The Geochemical Periodic Table, Nucleosynthesis	Lab #2
January 19	Accretion and Formation of the Solar System	Lab #3
January 26	Geochemical Reservoirs I - The Earth's core and its mantle	Lab #4
February 2	Geochemical Reservoirs II - The Earth's crust and its hydrosphere	Lab #5
February 9	Midterm Exam	No lab
February 16	Winter Break, no classes	
February 23	Exam review and feedback.	<i>*Lecture:</i> Geochemistry of Igneous Processes I
March 2	Geochemistry of Igneous Processes II	Lab #6
March 9	Introduction to Geochronology	Lab #7
March 16	Geochemistry project	Geochemistry project
March 23	Geochemistry project	Geochemistry project
March 30	Chemical Weathering	Lab #8
April 6	Introduction to Stable Isotopes	No lab
April. 11-23	Final exams , scheduled by University	

Important dates and deadlines (including class suspension for fall, winter breaks, and statutory holidays) can be found here: <https://carleton.ca/registrar/registration/dates/academic-dates/>.

Assessments

Research about learning strongly suggests that the most important factor in learning is doing the work of reading, writing, recalling, practicing, synthesizing, and analyzing. Learning happens best when people actively engage material on a consistent basis, and that is why we have high standards in this course. We are confident that, with appropriate effort, you all can meet those standards.

The midterm and final exams assess conceptual understanding of the geochemical processes and Earth evolution. Labs (assignments) emphasize application and interpretation of geochemical data, while the geochemistry project focuses on synthesis and communication.

Grade Breakdown

Midterm Exam (in-person): 30% (covers material from weeks 1-5; Monday February 9, 2025)
 Final Exam (in-person): 30% (not cumulative, during the April 2026 exam period)
 Assignments (labs): 25% (n=7–8, depending on pacing and term length)
 Geochemistry project: 15%

We aim to reduce unintentional bias in grading by using rubrics, grading anonymously where possible, and grading one question at a time.

Late and Missed Work Policies

Assignments

Assignments are completed during the 3-hour lab periods and should normally be finished within that time. If additional time is needed or if you are unable to attend a lab, you have up to one week to submit the assignment. Submissions after this period will not be accepted and will receive a grade of zero. One extension during the semester may be granted in cases of documented extenuating circumstances through the [academic considerations process](#).

Midterm Exam

Missed midterms may be deferred for documented extenuating circumstances if an [academic considerations form](#) is submitted within three days of the exam.

Final exam

Requests for accommodations during the formal exam period must follow the official [deferral process](#).

Learning Materials and Other Resources

Students are not required to purchase textbooks or other learning materials for this course. Recommended books below are available either online or through the library.

Required Tools

Students are expected to have regular access to a computer with spreadsheet software (e.g., Microsoft Excel) for data handling, graphical representation, and basic geochemical calculations. No advanced programming skills are required.

Brightspace

Course lecture slides and labs (assignments) will be posted on Brightspace. All information concerning the course, including assignments, will also be posted on the site. Note that posting of pdf copies of journal articles on Brightspace is a violation of copyright regulations. However, all students have access to journal articles via the library electronic subscriptions, and each student is allowed one copy for personal use.

Books

- Faure, G., 1998. Principles and Applications of Geochemistry: a comprehensive textbook for geology students. Prentice-Hall.
- White, W.M., 2013. Geochemistry. John Wiley & Sons, Inc. (Also available as an e-book).
- Albarède, F., 2013. Geochemistry; An Introduction. Cambridge University Press. (Also available as an e-book).

Websites

Webelements: <http://www.webelements.com/>

Geochemical Earth Reference Model (GERM): <http://earthref.org/GERM/>

Academic Accommodations and Regulations

Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes are outlined on the Academic Accommodations website (<https://students.carleton.ca/course-outline/>).

Support & Well-Being

If you are struggling or need support, Carleton offers resources through the [Student Support Services](#) (e.g., mental health support, counselling). Links and details are available via [Student Affairs](#) and the [Science Student Success Centre](#).

Use of Generative AI

Students may use AI tools for basic formatting support (e.g., grammar and spell checking). As our understanding of the uses of AI and its relationship to student work and academic integrity continue to evolve, students are required to discuss their use of AI in any circumstance not described here with the course instructor to ensure it supports the learning goals for the course. Substantive content creation must reflect the student's own understanding and work.

Online Community Expectations

University codes of conduct apply to all online interactions (e.g., Discord) related to this course. Students are expected to engage respectfully and professionally. Academic misconduct, including unauthorized collaboration or sharing of answers, will not be tolerated.

Statement on Academic Integrity

Students are expected to uphold the values of academic integrity, which include fairness, honesty, trust, and responsibility. Examples of actions that compromise these values include but are not limited to plagiarism, accessing unauthorized sites for assignments or tests, unauthorized collaboration on assignments or exams, and using artificial intelligence tools such as ChatGPT when your assessment instructions say it is not permitted.

Misconduct in scholarly activity will not be tolerated and will result in consequences as outlined in [Carleton University's Academic Integrity Policy](#). A list of standard sanctions in the Faculty of Science can be found [here](#).

Additional details about this process can be found on [the Faculty of Science Academic Integrity website](#).

Students are expected to familiarize themselves with and abide by [Carleton University's Academic Integrity Policy](#).

Student Rights & Responsibilities

Students are expected to act responsibly and engage respectfully with other students and members of the Carleton and the broader community. See the [7 Rights and Responsibilities](#)

[Policy](#) for details regarding the expectations of non-academic behaviour of students. Those who participate with another student in the commission of an infraction of this Policy will also be held liable for their actions.

Student Concerns

If a concern arises regarding this course, **your first point of contact is me:** Email or pass by my office and I will do my best to address your concern. If I am unable to address your concern, the next points of contact are (in this order):

Note: You can also bring your concerns to [Ombuds services](#).

