University of Victoria

Earth & Ocean Sciences 240 CRN 21312
UNIVERSITY OF VICTORIA
3-3-0 (1.5 UNITS)
SPRING TERM 2025

We acknowledge and respect the Lək̓ʷəŋən (Songhees and Esquimalt) Peoples on whose territory the university stands, and the Lək̓ʷəŋən and WSÁNEĆ Peoples whose historical relationships with the land continue to this day.

COURSE OUTLINE

EOS240: Geochemistry

Lectures: M/Th 10:00 to 11:20 AM in Cornett A125

PREREQUISITES: EOS110, EOS120, EOS205, 1 of CHEM254, PHYS217, PHYS317
COREQUISITES: NONE

CONTACT INFO

Instructor(s):	Blake Dyer	
Email:	blakedyer@uvic.ca	
Office:	BWC A419	
Office Hours:	M 1:00 to 2:00 PM	
Lab Coordinator	Eva MacLennan	evamegan@uvic.ca
Teaching Assistant(s)	XXXX	XXXX@xxxx.com
	XXXX	XXXX@xxxx.com

COURSE DESCRIPTION

In geochemistry, we use the tools of chemistry to understand the Earth and how it works. Principles of thermodynamics and kinetics will be applied to understand key processes that control of the geochemistry of the Earth, from the low temperature and pressure conditions of Earth's surface environment to higher temperature and pressure conditions in Earth's interior. We will consider processes operating on time scales of millions (planetary formation) to hundreds (climate change) of years. The lab will provide hands-on experience using real data to solve geological problems.

LEARNING OUTCOMES

Below is a list of some specific knowledge and skills you can expect to gain through this course. This term you will:

- Use geochemical data from rocks and meteorites to model the chemical composition of Earth
- Develop a thermodynamic basis for chemical partitioning between crystals and melt
- Predict the behavior of trace elements in both open and closed systems that are either melting or crystallizing
- Use melting models and the average composition of the oceanic and continental crust to reconstruct the history of mantle melting and continental crust creation
- Use radioactive decay to determine when a sample was extracted from Earth's primitive mantle
- Develop a thermodynamic basis for stable isotope fractionation
- Gain practical understanding on how we measure the mass-to-charge ratio of elements and isotopologues to determine the chemical and isotopic composition of geochemical samples
- Make quantitative comparisons of data and models to determine the best model parameters
- Use truncations of the Taylor series to numerically solve differential equations that represent time-dependent geochemical models

COURSE MATERIALS

There is no required textbook. Students are required to have access to a computer to work on assignments. Please let us know if you do not have access to a computer. Lab material and supplemental readings will be made available through the course Brightspace page.

BRIGHTSPACE

You are expected to routinely check the Brightspace site. All announcements, materials, supplemental readings, and schedule changes will be posted to brightspace.

EVALUATION

This course will use the official UVic standard grading scale. Your final grade will be determined by your scores on in-class exams and weekly laboratory assignments. Lab assignments **will require additional time** beyond the scheduled three hour lab period. These assignments are due before the next lab meeting (1 week to complete). There is no final exam.

Lecture		60%
Mid-term 1 (Jan 27, week 4)	15%	
Mid-term 2 (Feb 13, week 6)	15%	
Mid-term 3 (Mar 13, week 10)	15%	
Mid-term 4 (Apr 03, week 13)	15%	
Laboratory		40%
9 Lab Assignments	40%	

Students must pass ($> 50\%$) both the lab and lecture portion of this course to pass the course. In other words, a 100% average on the labs and a 49% average on the in class exams will result in a failing final grade (and vice versa).

COURSE POLICIES

If you need academic accommodation to address barriers to your education, please register with the Centre for Accessible Learning (CAL) as soon as possible. We work with the CAL to create a learning environment that is equitable, inclusive, and usable for all.

POLICY: CLASS CONDUCT

Please follow the latest provincial and University guidelines with regard to COVID-19 protocols: UVic COVID-19 information and what to do if you are ill. No materials from the course may be redistributed without written permission from the instructors (e.g., no posting of materials to sharing websites). If we are required to meet on Zoom, you should remain muted during lecture unless you are speaking to the class or instructors.

POLICY: LATE/MISSED ASSIGNMENTS OR EXAMINATIONS

Students are required to complete all exams to recieve a final grade in the course. If you must miss the an exam for a valid reason (illness, accident, family emergency etc.), you must notify the instructor as soon as possible, and you may be asked to provide documentation to support your request. If you miss an exam **with a valid excuse**, we will arrange a make up exam.

If a student does not sit an exam, they will be assigned a grade of **N** regardless of their performance in other elements of the course. A grade of **N** is a failing grade and will be scored as a zero in the calculation of the students CGPA. The maximum percentage grade that can be assigned for a student achieving a **N** grade is 49%.

The general approach to late submissions of lab assignments is a 10% grade penalty per day. Late assignments will not be accepted after marked assignments have been returned to others. However, if you know that you will miss a deadline due to a personal emergency, please let your lab instructors know as soon as possible and we will do our best to work with you to find a solution.

POLICY: ATTENDANCE

You are expected to be present and active in the lectures. We will not formally track participation in lecture, but from past experience we know that the assignments will be significantly easier to complete and exam scores are higher for those who attend and participate in lecture. Laboratory attendance is mandatory. If you will miss a lab for medical or other valid reasons, please contact the Lab Coordinator as soon as possible. Recall that **you must pass the lab to pass the course**.

POLICY: ACADEMIC INTEGRITY

It is every student's responsibility to be aware of the university's policies on ccademic integrity, including policies on cheating, plagiarism, unauthorized use of an editor, multiple submission, and aiding others to cheat.

If you have any questions or doubts, you can ask your course instructor or the Centre for Academic Communication.

COURSE FEEDBACK

I value your feedback on this course. Towards the end of term, as in all other courses at UVic, you will have the opportunity to complete an anonymous survey regarding your learning experience (CES). **The survey is vital for providing feedback** to me regarding the course and my teaching, as well as to help the department improve the overall program for students in the future. The survey is accessed online and can be done on your laptop, tablet, or mobile device. I will remind you and provide you with more detailed information nearer the time but please be thinking about this important activity during the course.

COURSE WEEKLY CALENDAR

This calendar will get updated throughout the term (last updated on: November 14, 2024). Exam dates are set, but lecture and lab topics are subject to change.

Week	Date	Lecture Topic
1	M Jan 6	Lecture 1 ... Course Introduction
	Th Jan 9	Lecture 2 ... Making the elements
		... No lab
2	M Jan 13	Lecture 3 ... The nebula
	Th Jan 16	Lecture 4 ... Condensation
		Lab 1 ... Partial melting of Olivine
3	M Jan 20	Lecture 5 ... Making the Earth
	W Jan 22	... Last day to add course
	Th Jan 23	Lecture 6 ... Melting olivine
		Lab 2 ... Trace elements in Earth's mantle
4	M Jan 27	Mid-term 1 ... Chemistry of Earth
	Th Jan 30	Lecture 7 ... Trace element compatibility
		Lab 3 ... Trace element partitioning
5	M Feb 3	Lecture 8 ... Batch crystallization
	Th Feb 6	Lecture 9 ... Fractional crystallization
		Lab 4 ... Chemical differentiation of the Earth
6	M Feb 10	Lecture 10 ... Fractional melting
	Th Feb 13	Mid-term 2 ... Trace elements
		Lab 4 ... Chemical differentiation of the Earth
7	M Feb 17	... Reading Break
	Th Feb 20	... Reading Break
		... No lab
8	M Feb 24	Lecture 11 ... Radioactive decay
	Th Feb 27	Lecture 12 ... Model ages
	F Feb 28	... Last day to drop a course without penalty of failure
		Lab 5 ... Sm-Nd Decay
9	M Mar 3	Lecture 13 ... The Carbon Cycle
	Th Mar 6	Lecture 14 ... Stable isotopes and fractionation
		Lab 6 ... The long term carbon cycle
10	M Mar 10	Lecture 15 ... Pleistocene Climate
	Th Mar 13	Mid-term 3 ... Element cycles and mass balance
		Lab 7 ... Cenozoic Climate
11	M Mar 17	Lecture 16 ... CO2 in seawater
	Th Mar 20	Lecture 17 ... CO2 in seawater
		Lab 8 ... Measuring Stable Isotopes
12	M Mar 24	Lecture 18 ... Alkalinity
	Th Mar 27	Lecture 19 ... Saturation
		... No lab
13	M Mar 31	Lecture 20 ... Redox in aqueous solutions
	Th Apr 3	Mid-term 4 ... Aquatic chemistry

APPENDIX

SCHOOL OF EARTH AND OCEAN SCIENCES INFO

- SEOS Website: uvic.ca/seos
- SEOS Office: seos@uvic.ca
- SEOS Director: Dr. Jay Cullen, seosdirector@uvic.ca
- SEOS Mental Health & Wellness Contact: Dr. Andy Fraass, andyfraass@uvic.ca
- SEOS Undergraduate Advisor: Dr. Jon Husson, seosadvisor@uvic.ca
- SEOS Graduate Advisor: Dr. Roberta Hamme, seosgradadvisor@uvic.ca
- Ocean Science Mentor: Dr. Jody Klymak, seosoceansci@uvic.ca
- Climate Science Advisor: Dr. Colin Goldblatt, climateadvising@uvic.ca

UNIVERSITY STATEMENTS & POLICIES

- Academic Calendar: Information for All Students
- Creating a respectful, inclusive, and productive learning environment
- Accommodation of Religious Observance
- Accommodation and Access for Students with Disabilities
- Student Conduct
- Non-academic Student Misconduct
- Accessibility
- Diversity / EDI
- Equity statement
- Sexualized Violence Prevention and Response
- Discrimination and Harassment Policy

UVIC GRADING SYSTEM

As per the Academic Calendar:

Grade	Grade point value	Grade scale	Description
A+ **A** **A-**	9 8 7	90-100% 85-89% 80-84%	**Exceptional**, **outstanding** and **excellent** performance. Normally achieved by a minority of students. These grades indicate a student who is self-initiating, exceeds expectation and has an insightful grasp of the subject matter.
B+ **B** **B-**	6 5 4	77-79% 73-76% 70-72%	**Very good**, **good** and **solid** performance. Normally achieved by the largest number of students. These grades indicate a good grasp of the subject matter or excellent grasp in one area balanced with satisfactory grasp in the other area.
C+ **C**	3 2	65-69% 60-64%	**Satisfactory**, or **minimally satisfactory**. These grades indicate a satisfactory performance and knowledge of the subject matter.
D	1	50-59%	**Marginal** Performance. A student receiving this grade demonstrated a superficial grasp of the subject matter.
F	0	0-49%	**Unsatisfactory** performance. Wrote final examination and completed course requirements; no supplemental.
N	0	0-49%	Did not write examination or complete course requirements by the end of term or session; no supplemental.

STUDENT RESOURCES

POSITIVITY AND SAFETY

The University of Victoria is committed to promoting, providing, and protecting a positive and safe learning and working environment for all its members.

Student Groups & Resources

ACADEMIC RESOURCES

UVic Library - *UVic Library offers many services and resources for undergraduate and graduate students.* uvic.ca/students/academics/library-services

Learning Resources - *UVic Learn Anywhere is the primary learning resource for students that offers many learning workshops and resources to help students with academics and learning strategies.* onlineacademiccommunity.uvic.ca/LearnAnywhere/learning-strategies

Centre for Academic Communication - *Offers online and in-person one-on-one tutorials, workshops, and more.* uvic.ca/learningandteaching/cac

Math & Stats Assistance Centre - *Offers drop-in, face-to-face tutoring and a friendly, collaborative study space for 100- and 200-level math and stats courses.* uvic.ca/science/math-statistics/current-students/undergraduate/msac

MENTAL HEALTH & WELLNESS

A note to remind you to take care of yourself. Do your best to maintain a healthy lifestyle this semester by eating well, exercising, getting enough sleep, and taking some time to relax. This will help you achieve your goals and cope with stress. All of us benefit from support during times of struggle. You are not alone.

SEOS Mental Health & Wellness Contact - *Dr. Fraass is a faculty member who can act as a sympathetic ear and (more importantly) provide guidance about: how to access the multitude of University support services, and which are useful in different circumstances. Andy can be found by dropping by his office or lab (Bob Wright A431, B409). He is also available via email for questions or to arrange a time to have a chat.* andyfraass@uvic.ca

Student Wellness Centre - *Our team of practitioners offers a variety of services to support students' mental, physical, and spiritual health.* uvic.ca/student-wellness

Counselling Services - *Counselling Services can help you make the most of your university experience. They offer free professional, confidential, inclusive support to currently registered UVic students.* uvic.ca/services/counselling/

Health Services - *University Health Services (UHS) provides a full-service primary health clinic for students and coordinates healthy student and campus initiatives.* uvic.ca/services/health/

ACCESSIBILITY

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a documented disability or health consideration that may require accommodations, please feel free to approach me and/or the Centre for Accessible Learning (CAL) as soon as possible.

Centre for Accessible Learning - *The CAL staff are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations. The sooner you let us know your needs the quicker we can assist you in achieving your learning goals in this course.* uvic.ca/services/cal/

ADVISING

For academic advising-related questions, students in the School of Earth and Ocean Sciences are also encouraged to meet with the SEOS Undergraduate Advisor (seosadvisor@uvic.ca) as well as an academic advisor in the Academic Advising Centre early in their studies to help map out a plan to declare a major and complete university program requirements.

Academic Advising Centre - *Academic advice and support is currently available by phone, email and virtual or in-person appointments.* uvic.ca/services/advising

Ombudsperson - *The ombuds office is an independent, impartial, and confidential resource for undergraduate and graduate students and other members of the University of Victoria community. The ombudsperson helps resolve student problems or disputes fairly.* uvicombudsperson.ca

ACADEMIC CONCESSION

You can request an academic concession if your course requirements are affected by unexpected and unavoidable circumstances, or conflicting responsibilities. Concession requests can be for an in-course extension, deferral, withdrawal under extenuating circumstances, or an aegrotat. Please speak to an advisor at the Academic Advising Centre if you have questions on how requesting a concession will affect your academic program.

Undergraduate Academic Concessions - uvic.ca/students/academics/academic-concessions-accommodations

EQUITY AND HUMAN RIGHTS AT UVIC

EQHR is a resource for students, staff, and faculty who have experienced sexualized violence, discrimination, and/or harassment and are looking for informal and/or formal resolution options as well as advice, coaching, and/or education. We are available for confidential consultations so that you can ask questions and learn your options.

EQHR – *By email at eqhr01@uvic.ca or in-person (Sedgewick C115).* uvic.ca/equity

Sexualized Violence Resource Office – *If you have been directly or indirectly impacted by sexualized violence, reach out to the SVRO for information, advice, resolution options (restorative and disciplinary) as well as support options and referrals. The SVRO is both survivor-centred and trauma-informed in their approach. You can reach us by phone at 250-721-8021 or by email at eqhr01@uvic.ca to book either an in-person (Sedgewick C119) or online appointment.* uvic.ca/svp

RESOURCES FOR INTERNATIONAL STUDENTS

International Centre for Students - *The primary office supporting international students on campus at the university-wide level.* uvic.ca/international-experiences

UVic Global Community Initiative - *Provides various supportive programming, including a Mentorship Program and Conversation Partner Program.*
uvic.ca/international-experiences/get-involved/uvic-global-community

RESOURCES FOR INDIGENOUS STUDENTS

Indigenous Student Support - *UVic offers holistic services to Indigenous students throughout their academic journey.* *uvic.ca/students/info-for/indigenous-students*

Elders in Residence - *The Office of Indigenous Academic and Community Engagement (IACE) has the privilege of assembling a group of Elders from local communities to guide students, staff, faculty, and administration in Indigenous ways of knowing and being.* *uvic.ca/services/indigenous/students/programming/elders*