

**Faculty of Science Course Syllabus
Department of Oceanography
OCEA / EARTH 3420
Geochemistry of Aquatic Environments
Winter 2023**

***Dalhousie University is located in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq. We are all Treaty people.
We acknowledge the histories, contributions, and legacies of the African Nova Scotian people and communities who have been here for over 400 years.***

Instructor(s): Markus Kienast e-mail: markus.kienast@dal.ca;

Office location: please e-mail instructor

Lectures: Mon/Wed/Fri 1135-1225, LSC-COMMON AREA C202, **in person, not recorded**

Laboratories: n/a

Tutorials: n/a

Course Description

This course is an introduction to the governing principles and processes of aquatic geochemistry. Specific topics will include physical chemistry of natural waters, kinetics of geochemical reactions, the hydrologic cycle, the carbonate system and pH, redox reactions, weathering and mineral-solution equilibria, controls on the composition of rainwater, rivers, and oceans.

Course Prerequisites

PREREQUISITES: CHEM 1011.03/1012.03 or equivalent and EARTH 1080.03/1090.03

Course Objectives/Learning Outcomes

*describe the water molecule and its different states (solid-liquid-gas), and account for changes in density as a function of temperature
summarize the fundamentals of the hydrological cycle
define salinity and identify the major dissolved ions and their cycling
know the basic transport processes of diffusion and advection
describe the basic circulation patterns in the ocean
explain the solubility of gases in water and illustrate the horizontal and vertical distribution of oxygen in the ocean
explain the cycling of the major nutrients, and account for their horizontal and vertical distributions in the ocean
summarize basic thermodynamics
summarize basic kinetics and define rates*

describe, explain and apply solubility/stability diagrams

define weathering

describe and explain basic build-up of clay minerals, and illustrate their behaviour in nature

illustrate basic acid-base reactions and build the Bjerrum plot

define, describe and illustrate the carbonate system in aquatic environments, primarily in the ocean

describe basic redox reactions

describe basic isotope geochemistry and apply this to the aquatic environment

Course Materials

Required textbook: [https://bookstore.dal.ca/CourseSearch/?course\[\]=SUB,WINT21,OCEA,OCEA3420,&](https://bookstore.dal.ca/CourseSearch/?course[]=SUB,WINT21,OCEA,OCEA3420,&)

Course Assessment

Component	Weight (% of final grade)	Date
<i>Mid-term exam</i>	20	tbd
<i>Final exam</i>	30	tbd
<i>Assignments, 4-5</i>	40	tbd
<i>Attendance/participation</i>	10	

There is no Supplementary Exam for this course.

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

A+ (90-100)	B+ (77-79)	C+ (65-69)	D	(50-54)
A (85-89)	B (73-76)	C (60-64)	F	(<50)
A- (80-84)	B- (70-72)	C- (55-59)		

Course Policies

General class format and communication:

All lectures for this course will be in person. Attendance and participation in all classes are essential and imperative. In turn, the course is designed such that class attendance constitutes the majority of the workload for this course. I will strongly encourage and support questions and discussion during class; it is in your best interest to take full advantage of this.

Assignments:

Students will generally have a week to complete an assignment, most often including a weekend. They are due at the end of class, not at the end of the day, and I will not generally answer questions concerning the assignment 24 hours prior to the due date. Late assignments may get 10% off for each day late and will not be accepted once the marking process has been completed.

Participation, plagiarism and cheating:

Students are encouraged, indeed required, to participate in class. However, each student must pass in their own assignment, reflecting their own work. Similarly, cheating and plagiarism will not be tolerated during the tests. You are expected to know and adhere to the Dalhousie Regulations on Academic Integrity, as outlined in the calendar.

Course Content

*water: properties, hydrological cycle,
chemical composition of rain and river waters
ocean: salinity, major/minor elements
advection/diffusion
gases in (sea)water
nutrients in (sea)water
thermodynamics
kinetics
solubility diagrams
weathering/soils
clay minerals: their composition, structure, distribution
acid/base reactions
the carbonate system and pH
radionuclides, isotopes*

University Policies and Statements

This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate

Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.

Information: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).

Information: https://www.dal.ca/campus_life/academic-support/accessibility.html

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution.

Code: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness

Statement: <http://www.dal.ca/cultureofrespect.html>

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit or e-mail the Indigenous Student Centre (1321 Edward St) (elders@dal.ca).

Information: https://www.dal.ca/campus_life/communities/indigenous.html

Important Dates in the Academic Year (including add/drop dates)

<https://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=117&chapterid=-1&topicgroupid=31821&loaduseredits=False>

University Grading Practices

https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html

Student Resources and Support**Advising**

General Advising https://www.dal.ca/campus_life/academic-support/advising.html

Science Program Advisors: <https://www.dal.ca/faculty/science/current-students/undergrad-students/degree-planning.html>

Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html

Black Students Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html

International Centre: https://www.dal.ca/campus_life/international-centre/current-students.html

Academic supports

Library: <https://libraries.dal.ca/>

Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html

Studying for Success: https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

Copyright Office: <https://libraries.dal.ca/services/copyright-office.html>

Fair Dealing Guidelines <https://libraries.dal.ca/services/copyright-office/fair-dealing.html>

Other supports and services

Student Health & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness.html

Student Advocacy: <https://dsu.ca/dsas>

Ombudsperson: https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html

Safety

Biosafety: <https://www.dal.ca/dept/safety/programs-services/biosafety.html>

Chemical Safety: <https://www.dal.ca/dept/safety/programs-services/chemical-safety.html>

Radiation Safety: <https://www.dal.ca/dept/safety/programs-services/radiation-safety.html>

Scent-Free Program: <https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html>

Dalhousie COVID-19 information and updates: <https://www.dal.ca/covid-19-information-and-updates.html>