DALHOUSIE UNIVERSITY

Faculty of Science Course Syllabus
Department of *Oceanography*
OCEA / ERTH 3420
Geochemistry of Aquatic Environments
Winter 2024

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: ***in person, not recorded***

Mon/Wed/Fri 1335-1425, Mondays room LSC 3655, Wednesdays/Fridays room Dunn bldg. 221C

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 ERTH 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

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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**:* *J. Drever – The Geochemistry of Natural Waters; available online through the bookstore, details tbd.*

Course Assessment

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

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***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

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Faculty of Science Course Syllabus (Section C) **(revised April-2022)**

Fall/Winter 2023-24

OCEA/ERTH 3420

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

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University Policies and Statements

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 at 1321 Edward St or elders@dal.ca. Additional information regarding the Indigenous Student Centre can be found at: https://www.dal.ca/campus_life/communities/indigenous.html

Internationalization

At Dalhousie, 'thinking and acting globally' enhances the quality and impact of education, supporting learning that is "interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders." Additional internationalization information can be found at: https://www.dal.ca/about-dal/internationalization.html

Academic Integrity

At Dalhousie University, we are guided in all our work by the values of academic integrity: honesty, trust, fairness, responsibility, and respect. As a student, you are required to demonstrate these values in all 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. Additional academic integrity information can be found at: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion, please contact the Student Accessibility Centre (https://www.dal.ca/campus_life/academic-support/accessibility.html) for all courses offered by Dalhousie with the exception of Truro. For courses offered by the Faculty of Agriculture, please contact the Student Success Centre in Truro (https://www.dal.ca/about-dal/agricultural-campus/student-success-centre.html)

Conduct in the Classroom – Culture of Respect

Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While

expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

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 (Strategic Priority 5.2). Additional diversity and inclusion information can be found at: http://www.dal.ca/cultureofrespect.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. The full Code of Student Conduct can be found at: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Fair Dealing Policy

The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. Additional information regarding the Fair Dealing Policy can be found at: https://www.dal.ca/dept/university_secretariat/policies/academic/fair-dealing-policy-.html

Originality Checking Software

The course instructor may use Dalhousie's approved originality checking software and Google to check the originality of any work submitted for credit, in accordance with the Student Submission of Assignments and Use of Originality Checking Software Policy. Students are free, without penalty of grade, to choose an alternative method of attesting to the authenticity of their work and must inform the instructor no later than the last day to add/drop classes of their intent to choose an alternate method. Additional information regarding Originality Checking Software can be found at: https://www.dal.ca/dept/university_secretariat/policies/academic/student-submission-of-assignments-and-use-of-originality-checking-software-policy-.html

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Student Use of Course Materials

Course materials are designed for use as part of this course at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading to a commercial third-party website) may lead to a violation of Copyright law.