

TITLE: Introduction to Environmental Chemistry of the Arctic
NUMBER: CHEM 111X (on-campus CRN: TBD; Distance CRN: TBD)
CREDITS: 3
PREREQUISITES: DEVM 105 or higher placement
LECTURE: Monday, Friday 3:30-4:30 pm (Campus: REIC 138; Dist: Blackboard Collaborate)
LABORATORY: Wednesday 2:15-5:15 pm (Campus: REIC 245; Distance: lab kit)
DISTANCE: Distance: Remotely attend 2 hr synchronous lecture via Blackboard Collaborate or, if needed, watch lectures asynchronously. Lab experiments and collaboration performed asynchronously.

Instructors:	Dr. Sarah Hayes	Dr. Jennifer Guerard
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Office Hours:	TBD, or by appointment	TBD, or by appointment

COURSE DESCRIPTION

This course introduces students to environmental chemistry through investigating the air, water, and soil quality of the arctic environment as affected by natural and anthropogenic cycling of nutrients and contaminants. The lab component will focus on characterization of natural waters collected around the state. This course is offered both on campus and by distance. Pre-requisites: Completion of DEVM 105 or placement in higher

EXPANDED COURSE DESCRIPTION

This course introduces students to environmental chemistry through investigating the air, water, and soil quality of the arctic environment as affected by natural and anthropogenic cycling of nutrients and contaminants. The lab component will focus on characterization of natural waters collected around the state through the use of collaborative research teams, made of a combination of distance and on-campus students, depending on enrollments. All students will have the same lab experiences, except for lab weeks 3 and 4 of the semester, when some students (all distance students and some on campus students) will sample natural waters and do on-site analysis and some on-campus students be exposed to advanced instrumentation that will be used to analyze collected samples, depending on abilities and roles on the research team. These different experiences will be shared within and between research teams through the use of screencasts (due week 5).

Within each research team, there will be a site expert (all distance students and some on campus students), while other on-campus students will be instrumentation experts, thereby contributing unique knowledge to strengthen the team. Site experts will have the opportunity to share their field sites with their on-campus team through photos, videos, and screencasts, but maintain an inherently better understanding of their unique sampling sites. Instrumentation experts will develop expertise on advanced instrumentation used by the TA to collect data on natural water samples and share that information with the rest of the class, particularly distance students, through screencasts. Although on-campus students will have a more interactive experience with advanced instrumentation because they will have a tour with the TA operating the instruments, distance students will be included asynchronously through virtual tours available to all students. In all cases, students will be provided with equivalent opportunities.

COURSE GOALS



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Students will gain an appreciation of the influence of chemistry in the natural, arctic environment and the implications of human-caused perturbations of these systems and potential remediation strategies.

STUDENT LEARNING OUTCOMES

Upon successful completion of this course, students will:

- Understand the basic chemical concepts as they relate to the function of ecosystems and the existence/transformation of contaminants.
- Outline basic metrics for assessing air, water, and soil quality and explain their importance as indicators of environmental health.
- Identify examples of anthropogenic influences of natural cycles and explain how that impacts ecosystem health.
- Evaluate student-generated water quality data from across the state and interpret data to assess anthropogenic perturbation of ecosystems.

COURSE READINGS/MATERIALS

Required Textbook: Environmental Science for a Changing World 1st edition. By Karr, Houtman, Interlandi. ISBN:978-1-4641-2938-4

Other required readings are available on Blackboard.

In order to participate in this class, distance students will be provided with a lab kit by mail. When you registered for the course, a refundable \$250 deposit was charged to your account for the distance lab kit.

Lab kits will be shipped by the middle of August and students should receive them by the start of the course. If you drop the course, you must return a complete lab kit (in a condition that is usable by another student) in order to receive a refund of \$250. The amount will be credited to your student account after it has been received and inventoried at UAF.

TECHNICAL REQUIREMENTS FOR COURSE

Students must have regular access to a computer and the Internet to access online materials in Blackboard. Students will be expected to download course material as well as upload assignments. Students are also expected to regularly use their UAF Gmail accounts, Blackboard, Google Hangouts, and screencast-o-matic as methods of collaboration and sharing of their understanding.

Tablets will be loaned to distance students for the duration of the semester. Tablets will be preloaded with most required applications and information. At the end of the semester, you will need return the tablet and probes provided in the lab kit to your instructors. Upon arrival, the probes were packaged in an addressed, stamped container. Keep the probes in this box during the semester, when not in use, and use it to return the probes and tablet at the end of the semester. After the tablet and probes have been received at UAF, the \$250 lab kit fee will be refunded to your student account.

INSTRUCTIONAL METHODS

Course material will be delivered through a combination of lectures incorporating active learning techniques, lab exercises (a combination of virtual, field, and kitchen-based labs), and weekly activities (ie case studies, interviews with experts, developing screencasts, etc). Research teams of on-campus and distance students (team makeup will vary with enrollments, but at max enrollment research teams



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will comprise 2 on-campus and 1 distance students) will generate lab-based replicate data sets of surface water quality data from communities across the state. Student groups will work closely and engage in peer mentoring (some students will develop expertise on the field site while others develop expertise in instrumentation) and build a community of learners across the state of Alaska.

COURSE SCHEDULE

See attached.

COURSE POLICIES

Continued attendance to class indicates each student agrees to the policies set forth in this syllabus. Distance course attendance will be measured through effort on assignments, collaborative activities, and exams.

Collaboration and Classroom Behavior - Collaboration and working in small groups is a key component of classroom and lab time. Your group is there to support your learning, not do the work for you. Students are expected to conduct themselves in a professional manner at all times. Disrespect of the classroom learning environment, instructors, and fellow students will not be tolerated!

Late work- Late work will be accepted at a 10% per day reduction of the points possible. This is in an effort to keep the entire class moving through the projects efficiently. Emergency situations will be dealt with as needed.

Instructor-Initiated Withdrawals- Any time up to and including the last day to drop with a "W", the professor has the right to withdraw a student that "...has not participated substantially in the course." In CHEM 111 nonparticipation includes:

- (1) Either of the first two assignments are not turned in within 1 week of the due date,
- (2) Exam I is missed without an excused absence,
- (3) one or more lab reports are not turned in within 1 week of the date due, or
- (4) completes less than 2/3 of homework assignments.

EVALUATION POLICIES

There are **1000 total points available** in this class. Grades are assigned as follows: 1000-900 A, 899-800 B, 799-700 C, etc. The instructors reserve the right to adjust grading scheme to the student's benefit.

Reading checks	10 pts x 14 weeks= 140 points possible	125
Online discussion	20 pts x 14 weeks= 280 points possible	255
Labs	30 pts x 12 labs = 360 points	360
Hour exams	100 pts x 2 exams = 200 points	200
Final presentation		60
Total points		1000

Reading Checks (est. 2-3 hrs per week)- Each week, 5 pts are available for chapter readings and 5 pts for case study. Reading checks are 3-5 question multiple choice tests administered through Blackboard that address student reading comprehension and highlight important issues that are will be pertinent to lecture and discussions. Reading assessment assignments will be due Mondays and Fridays at 12pm, before class begins. Of the 140 points possible, only 125 will be counted toward the final grade.

Online Discussion (est. 2-3 hrs per week)- Each week, 15 points are available for posting to online discussion topics (due Friday at 6pm) and 5 pts are available for replying thoughtfully to others posts



(Due Mondays at 12pm). Discussion posts evaluated on the basis of on time submission of all posts, pertinence of posts to question asked, and reflect scientific understanding. Discussion responses must be thoughtful, respectful, clearly relate to the original post, and move discussion forward. A total of 280 points are possible, of which 255 will be counted toward the final grade.

Labs (est. 3 hrs per week)- Twelve lab experiments will be performed during the semester, each worth 30 points. Lab reports will be exchanged between students and the instructors using Blackboard. Feedback on lab reports, the 5-question survey in blackboard, is worth 5 points each week. The remaining 25 points are based on on-time submission and completion of experiments. Laboratory reports are evaluated for correct prelab questions (5 pts), all measurements are recorded (10 pts), reasonable based on the experiment performed, which make it obvious the experiment was performed correctly (10 points), and thoughtful addressing of post-lab questions (5 pts).

Exams- Two hourly exams are scheduled, a midterm and final exam. Exam questions probe conceptual level understanding and student synthesis of material presented in the course. The questions are typically essay format questions and are open note, book, internet, and mind. The only resource not allowed is other students. Requirements of student responses are clearly articulated within each exam question. Questions probe scientific understanding of course material and the relationship of that material to other course content as well as to the overall environmental health of the arctic.

Final Presentation- Final presentations on surface water characterized during the semester will be performed during the final exam period. Presentations are evaluated on the basis of the information conveyed about the water quality at their site, development of professional slides, and delivery of an interesting, concise presentation.

Successful, timely completion of this course depends on committing yourself early and maintaining your effort. To this end, this course adheres to the following UAF eLearning Procedures:

INSTRUCTOR RESPONSE TIME

The instructors will attempt to respond promptly to student emails during normal business hours, but response times may be up to 24 hours. Assignments graded by instructors (e.g., lab reports, exams, blog posts) will generally be returned within 48 hours after assignment due date but no longer than a week. Grades in Blackboard will be updated weekly.

HOW TO CHECK YOUR GRADE

To check your grades for assignments and find comments from your instructor, click on the My Grades link in the sidebar menu in Blackboard. All the assignments and their due dates are listed. If your instructor has left comments, there will be a Comments link. Click on this link to view comments.

- If the score is for a test or quiz, click on the check mark or your score to see results and feedback.
- If the score is for an assignment, the title of the assignment is a link and by clicking this link you'll be taken to your submission, grade and comments.
- If you see a green explanation point, your assignment has not been graded yet.

EFFORT AND STUDENT INVOLVEMENT*

The categories below demonstrate how the 2 hours of lecture, 3 hours of lab and 4 hours of non-lecture in a face to face course translate into 9 hours of work in an online course, meeting the requirement of 9 hours of work per week for a 3 credit course. This calculation covers the entire course.

1. INSTRUCTION: lectures 22%

2. INDIVIDUAL RESEARCH: lab experiments 33%



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3. **ASSIGNMENTS:** readings, case studies, quizzes, homework 22%

4. **COLLABORATION:** case studies, laboratory project 23%

*This metric of student effort is used during development to ensure rigor and alignment with the federal guidelines and definitions for credit hour equivalents for online learning and other out-of-classroom work. This portion of the syllabus is for development purposes only and students will see only the sections required by Faculty Senate in their syllabus.

EXPECTATION OF STUDENT EFFORT

Students should expect to spend 9 hours per week on this class. Students are expected to complete the weekly assignments by their due dates.

If circumstances arise that cause you to need extra time on any assignment(s), e-mail your instructor for guidance. Extensions of due dates may be granted, but your instructor expects to be informed in advance if you are not able to submit your assignment on time. Students are expected to maintain a working backup plan to be implemented in the event of a computer malfunction or an interruption of their normal Internet service during the course.

ACADEMIC INTEGRITY

Honor code and Academic integrity- Students are expected to conduct themselves in accordance with the UAF Honor code. The Chemistry Department policy states: *Any student caught cheating will be assigned a course grade of F. The students' academic advisor will be notified of this failing grade and the student will not be allowed to drop the course.*

As described by UAF, scholastic dishonesty constitutes a violation of the university rules and regulations and is punishable according to the procedures outlined by UAF. Scholastic dishonesty includes, but is not limited to, cheating on an exam, plagiarism, and collusion. Cheating includes providing answers to or taking answers from another student. Plagiarism includes use of another author's words or arguments without attribution. Collusion includes unauthorized collaboration with another person in preparing written work for fulfillment of any course requirement. Scholastic dishonesty is punishable by removal from the course and a grade of "F." For more information go to Student Code of Conduct.

(<http://uaf.edu/usa/student-resources/conduct>)

SUPPORT SERVICES

UAF eLearning Student Services helps students with registration and course schedules, provides information about lessons and student records, assists with the examination process, and answers general questions. Our Academic Advisor can help students communicate with instructors, locate helpful resources, and maximize their distance learning experience. Contact the UAF eLearning Student Services staff at 907. 479.3444 or toll free 1.800.277.8060 or contact staff directly – for directory listing see: <http://elearning.uaf.edu/contact>

UAF Help Desk

Go to <http://www.alaska.edu/oit/> to see about current network outages and news.

Reach the Help Desk at:

- e-mail at helpdesk@alaska.edu
- fax: 907.450.8312
- phone: 450.8300 (in the Fairbanks area) or 1.800.478.8226 (outside of Fairbanks)

DISABILITIES SERVICES - The **UAF Office of Disability Services** operates in conjunction with UAF eLearning. Disability Services, a part of UAF's Center for Health and Counseling, provides academic accommodations to enrolled students who are identified as being eligible for these services.



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If you believe you are eligible, please visit their web site (<http://www.uaf.edu/disability/>) or contact a student affairs staff person at your local campus. You can also contact Disability Services on the Fairbanks campus by phone, 907.474.5655, or by e-mail (uaf-disabilityservices@alaska.edu).

VETERAN SUPPORT SERVICES - Walter Crary (wecrary@alaska.edu) is the Veterans Service Officer at the Veterans Resource Center (111 Eielson Building, 474-2475). Fairbanks Vet Center 456-4238. VA Community Based Outpatient Clinic at Ft. Wainwright is 361-6370.



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Tentative Lecture and Lab Schedule

Week 1 – Introduction

Reading: Environmental Science, Ch 1-2

Case study: *The Obligation to Endure*, an excerpt from *Silent Spring* by Rachel Carson

Lab 1: Safety and Scientific Method

- Safety map and contract
- Data interpretation and testable observations
- Neutralization of acids and bases

Week 2 – Air Quality

Reading: Environmental Science, Ch 3, 25

Case study: *Bear Trouble*

Lab 2: Modeling Air Quality and Introduction to pH

- HYSPLIT modeling of air plumes
- PHET simulation- pH scale basics
- pH of household items

Week 3: Introduction to Water Quality

Reading: Environmental Science, Ch 17

Case study: *Tricolsan in water treatment – from research to regulation in Minnesota*

Lab 3: Water Quality and Contamination

- Effects of water contamination
- Water treatment
- Practice with environmental probe measurements

Week 4: Water Quality and Treatment

Reading: Environmental Science, Ch 18

Case study: *Interview with CH2M Hill professionals*

Lab 4: Sampling Surface Water- Distance

- Selecting a sample site
- Sampling natural waters
- Sample preservation
- Distance students: Prepare and ship samples to UAF for additional analysis.
- On campus students: Jigsaw of analytical techniques.

Week 5 – Water Quality of Groundwater

Reading: Environmental Science, Ch 7

Case study: *Sulfolane*

Lab 5: Surface Water Analysis

- Surface water characterization
- Virtual stream lab
- Site descriptions (distance) and analytical jigsaw screencasts (on-campus) due.

Week 6- Marine Water Quality

Reading: Environmental Science, Ch 15, 16

Case study: *Effects of ocean acidification on corals*

Lab 6: Marine Water Quality and Ocean Acidification

- Effect of atmospheric CO₂ on ocean pH
- Shell stability upon ocean acidification

Week 7 – Contaminant Transport and Transformation



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Reading: Environmental Monitoring and Characterization, Ch 16 *Available on blackboard*

Case study: PCBs in salmon causing accumulation in spawning lake sediments

Lab 7: Contaminant Partitioning

- Contaminant partitioning in the environment

Week 8– Weathering and Soil Formation

Reading: Environmental Science, Ch 19, 23

Case study- How permanent is permafrost?

Lab 8: Weathering and Soil Formation

- Rocks into soil
- Exploring Alaskan soils

Week 9 – Metals and Inorganic Contaminants

Reading: Environmental Science, Ch 24

Case study – Pebble mine: Tension between mineral recovery, fishing, and community health

Lab 9: Soil Quality and Contamination

- Soil contamination
- Treating acid mine drainage

Week 10 – Environmental Microbiology I

Reading: Environmental Science, Ch 6, Environmental Monitoring and Characterization, Ch 14

Case study: Coliforms in Antarctica

Lab 10: Microbiology of Soils

- Virtual microscope
- Virtual pond dip

Week 11 – Environmental Microbiology II

Reading: Environmental Science, Ch 7

Case study – Oil Biodegradation and Bioremediation: A Tale of the Two Worst Spills in US History

Lab 11: Biodiversity and Biomagnification

- Yeast responses to pollution
- Biomagnification

Week 12 – Ecological Interactions and Bioaccumulation

Reading: Environmental Science, Ch 9

Case study: Bioaccumulation in the Arctic

Lab 12: no lab, Thanksgiving

Week 13 –Forest Fires & Ecological Succession

Reading: Environmental Science, Ch 26

Case study: Primary succession following deglaciation at Glacier Bay, Alaska

Lab 13: Sharing project data. Peer research project presentations, peer evaluations

Week 14 - Climate Change in the Arctic

Reading: Environmental Science, Ch 28

Case study: What does the data tell us about climate change?

Lab 14: Energy Sources and Climate Change

- Energy sources and alternative energy
- Climate change

Week 15 – Peer Research Presentations, Story GIS Project



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Tentative Course Schedule

Wk.	Date	Topic	Laboratory
0	Sept 4	Introduction to the course	No lab
1	Sept 7 Sept 11	Labor Day Introduction to Environmental Chemistry	1: Safety and Scientific Method
2	Sept 14 Sept 18	Air Quality	2: Modeling Air Quality and Introduction to pH
3	Sept 21 Sept 25	Introduction to Water Quality	3: Water Quality and Contamination
4	Sept 28 Oct 2	Water Quality and Treatment	4: Sampling Surface Water
5	Oct 5 Oct 9	Water Quality of Groundwater	5: Surface Water Analysis
6	Oct 12 Oct 16	Marine Water Quality	6: Marine Water Quality and Ocean Acidification
7	Oct 19 Oct 23	Contaminant Transport and Transformation EXAM 1	7: Contaminant Partitioning
8	Oct 26 Oct 30	Weathering and Soil Formation	8: Weathering and Soil Formation
9	Nov 2 Nov 6	Metals and Inorganic Contaminants	9: Soil Quality and Contamination
10	Nov 9 Nov 13	Environmental Microbiology I	10: Microbial World
11	Nov 16 Nov 20	Environmental Microbiology II	11: Biodiversity and Biomagnification
12	Nov 23 Nov 27	Ecological Interactions and Bioaccumulation Thanksgiving	No lab
13	Nov 30 Dec 4	Forrest Fires and Ecological Succession	Group work on presentations
14	Dec 7 Dec 11	Climate Change in the Arctic	14: Energy Sources and Climate Change
15	Dec 14 Dec 18	EXAM 2 3:15-5:15 pm Final Exam- Student Presentations	

