

ENVS 23: The Physical and Chemical Environment

Professor Michael E. Loik
Summer 2024

COURSE INFORMATION

Welcome! This course is about the physics and chemistry of the environment, and how they affect plants, animals, soils, ecosystems, people, and society. The class will be asynchronous and online. The timing is self-paced but short, so you will need to stay engaged. You can get to the Canvas site for this course by clicking [here](#).

INSTRUCTOR INFORMATION

I love everything about the physics and chemistry of the environment. I live this subject. My research is largely about how the physics of the environment affects everything that plants, biological communities, and ecosystems do. I can't help it: I am a total nerd. You will see proof of that during this class.

LEARNING OUTCOMES

By the end of the quarter, you should be able to:

1. Recall how physical phenomena affect plants, animals, soils, and people.
2. Explain how chemical principles improve our understanding and management of the environment.
3. Interpret data, graphs, tables and maps about the physical and chemical environment.
4. Take action in a way that can improve the lives of people who are impacted by the inequities in the physics and chemistry of their environment.

PREREQUISITES/COREQUISITES

There are no pre-requisites or co-requirements for this class. However, I hope you will bring a sense of curiosity, imagination, care, respect, and fun to this class!

REQUIRED MATERIALS, TEXTBOOKS AND TECHNOLOGY

Readings for the course will come from three texts available free from the UC Library:

Hanif. (2020). *Environmental Chemistry : A Comprehensive Approach*. Scrivener Publishing LLC.

O'Neill. (2017). *Environmental Chemistry (Third edition.)*. Routledge.

I will demonstrate how to find and bookmark (or "pin") these texts in class.

Please bring a notebook computer, tablet or phone to class to access Canvas for in-class check-ins.

COMMUNICATION

I am fine with you calling me Michael. Or Professor Loik. Whatever you are comfortable with.

I use the 24-h clock because it is unambiguous, which is especially important when working with colleagues in other parts of the world, or when doing physiological research on plants at night. I'll show a photo or two about this. To change an afternoon or evening time in 24-h clock time to "pm", subtract 12. For example, 14:00 h – 12 = 2 pm.

My office hours will be on Zoom Tuesdays from 14:00 to 15:00 h (2 – 3 pm) and Wednesdays from 11:00 to 12:00 h. On these days I will usually be Zooming from home. There will likely be a cat on my lap.

I prefer if you need to reach me that you do so via email (mloik at ucsc dot edu). If you email me you can expect an answer usually within 24 hours. It may be longer on weekends.

ASSIGNMENTS & ASSESSMENT

Your learning will be assessed based on a number of items:

Module quizzes: these will be low-stress quizzes on Canvas. There will be nine throughout the session, and the one with the lowest score will be dropped. Each quiz will have five to ten questions and will graded out of ten. Total value = 55% of overall grade.

Assignments: there be four assignments this session. They should take 60 to 90 minutes to complete, and they will provide an opportunity to express your learning differently from the quizzes. One of the assignments will be done as a group. Total value = 20% of overall grade.

Midterm exam: there will be a midterm examination consisting of questions whose format will be much like those on the module quizzes. Total value = 10% of overall grade.

Final exam: The final exam will cover all material for the session but will focus on material from after the midterm. Total value = 15% of overall grade.

Grade breakdown:

Item	Date(s)	% of overall grade
Module quizzes	Each of 9 modules	55
Assignments (4)	Multiple, see below	20
Midterm exam	Halfway Point	10

Final exam	End of Session	15
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Will the course grades be curved? Individual assignments, quizzes, and exams will not be curved. However, at the end of the session a curve may be applied depending on the performance of the entirety of the class.

Assignments:

Assignment One: *The Environment in Your Hometown*. This assignment will consist of short answer, essay-style questions.

Assignment Two: *Calculating Energy Budgets*. This will be the group assignment and will require some mathematical computations.

Assignment Three: *Climate Change & The Global Food System*. This assignment will consist of short answer, essay-style questions.

Assignment Four: *Engaging Elected Officials About the Environment*. This assignment will require you to write a letter to an elected official regarding environmental issues that have a physical/chemical component (e.g., acid rain.) Mailing the letter is not required.

I recommend that you plan to spend between 90 and 120 minutes to complete each assignment. If you find that it is usually taking you longer than 120 minutes to complete your assignment, come talk to me so we can figure out why!

Estimated Time Requirements:

This is a 5-unit course, which requires 150 hours of work. By the end of the session you should have spent the 150 hours roughly in the following proportions: the lecture videos should equal 32.5 hours, expect eight hours for assignments, three hours for the midterm, and the balance (about 105 h) for reading and online interaction with fellow students.

GRADING POLICY

Assignments will be posted and handed-in as uploads onto Canvas. There is no TA for the class, so Prof. Loik will be providing some feedback whereas some grading will be done automatically by Canvas. Because this is an asynchronous class, items will be due on a weekly basis to provide flexibility. Everything will have a hard due date at the end of the session.

INSTRUCTOR FEEDBACK

Feedback will be provided by me: I will add direct comments and feedback on your assignments, as applicable. There will be a grading rubric that will be available to you prior to submitting your work.

STUDENT FEEDBACK

At the end of the quarter you will be asked to complete a Student Experience of Teaching survey for this course. SETs provide an opportunity for you to give valuable feedback on

your learning that is honest and constructive. This anonymous feedback will help me consider modifications to the course that will help future students learn more effectively. Before you fill out your SET, please consult this website: [CITL's Guide to Giving Useful Feedback to Instructors and TAs](#).

COURSE SCHEDULE

Module	Content Topic	Readings
One	Chemistry, Physics, Life & Society <ul style="list-style-type: none"> ● Course Introduction ● Scientific Inquiry: What Can Science Tell Us? ● Atoms, Forces, Materials & Energy 	Selected Short Readings
Two	Third Stone From The Sun , Earth's Origins, the Lithosphere <ul style="list-style-type: none"> ● Formation of Earth ● Origins of Life ● History of Life 	Hanif (H) Chs. 1, 6 O'Neill (O) Ch. 1
Three	Water is a Crazy Substance Earth's Water, the Hydrosphere <ul style="list-style-type: none"> ● Physics & Chemistry of Water ● Water & Life ● The Water Cycle 	H Ch. 4
Four	Earth's Air , The Atmosphere <ul style="list-style-type: none"> ● Global Circulation ● Air Masses & Weather 	H Ch. 2 O Ch. 2
Five	This Land Is Your Land Land Use & Land Use Change <ul style="list-style-type: none"> ● Soil Chemistry & Physics ● Soil Biology & Complexity 	H Ch. 8
Six	Feels Like Summer Climate Change, Industrialization <ul style="list-style-type: none"> ● Elevated CO₂ ● Temperature & Precipitation Changes 	<i>The Climate System</i> , Canvas
Seven	Mercy, Mercy Me <ul style="list-style-type: none"> ● Air Quality, Ozone ● Short-Lived Pollutants ● Urban Heat Islands 	H Ch. 3
Eight	Trouble In The Water <ul style="list-style-type: none"> ● Water Pollution ● Groundwater Use & Overdraft ● Seawater incursion 	H Ch. 5

Nine	There Are Too Many of Us <ul style="list-style-type: none"> ● Human Population & Resource Use ● Solid waste ● Plastics 	H Chs. 10-12
Ten	What Can You Do? Adaptation & Mitigation <ul style="list-style-type: none"> ● Mitigation, Adaptation ● Nature Based Solutions 	H Chs 14, 15

FINAL EXAM DATE AND TIME

The Final Exam will be taken online and due by the end of Summer Session 1.

SCIENTIFIC INQUIRY

Science provides us with a way of knowing about ourselves, our world, and our universe. It is done by a specific process (the Scientific Method) that ensures reproducibility and provides a way for theories to be built. Science generally (but not always) tests *hypotheses* (postulates, or potential explanations for observed phenomena), and the accumulation of knowledge over time results in *theories* (frameworks of facts about a particular subject.) Note that hypotheses and theories are often incorrectly treated as synonyms in public usage. Scientific studies are vetted by peer review, in which experts judge scientific manuscripts for accuracy, precision, and relation to the literature. I will describe scientific inquiry in more detail during the first day of class, and demonstrate numerous examples throughout the course.

ACADEMIC INTEGRITY

All members of the UCSC community benefit from an environment of trust, honesty, fairness, respect, and responsibility. You are expected to present your own work and acknowledge the work of others in order to preserve the integrity of scholarship.

Academic integrity includes:

- Following exam rules
- Using only permitted materials during an exam
- Viewing exam materials only when permitted by your instructor
- Keeping what you know about an exam to yourself
- Incorporating proper citation of all sources of information
- Submitting your own original work

Academic misconduct includes, but is not limited to, the following:

- Disclosing exam content during or after you have taken an exam
- Accessing exam materials without permission
- Copying/purchasing any material from another student, or from another source, that is submitted for grading as your own
- Plagiarism, including use of Internet material without proper citation
- Using cell phones or other electronics to obtain outside information during an exam without explicit permission from the instructor
- Submitting your own work in one class that was completed for another class (self-plagiarism) without prior permission from the instructor.
- Violations of the Academic Integrity policy can result in dismissal from the university and a permanent notation on a student's transcript. For the full policy and disciplinary procedures

on academic dishonesty, students and instructors should refer to the [Academic Misconduct page](#) at the [Division of Undergraduate Education](#).

ACCESSIBILITY

Your success in this class is important to me. We will all need accommodations because we all learn differently. If there are aspects of this course that prevent you from learning or exclude you, please let me know as soon as possible. Together we will develop strategies to meet both your needs and the requirements of the course.

UC Santa Cruz is committed to creating an academic environment that supports its diverse student body. If you are a student with a disability who requires accommodations to achieve equal access in this course, please submit your Accommodation Authorization Letter from the Disability Resource Center (DRC) to me privately during my office hours or by email, preferably within the first two weeks of the quarter. At this time, I would like us to discuss ways we can ensure your full participation in the course. I encourage all students who may benefit from learning more about DRC services to contact the DRC by phone at 831-459-2089 or by email at drc@ucsc.edu.

INTELLECTUAL PROPERTY

The materials in this course are the intellectual property of their creators. As a student, you have access to many of the materials in the course for the purpose of learning, engaging with your peers in the course, completing assignments, and so on. You have a moral and legal obligation to respect the rights of others by only using course materials for purposes associated with the course. For instance, you are not permitted to share, upload, stream, sell, republish, share the login information for, or otherwise disseminate any of the course materials, such as: video and audio files, assignment prompts, slides, notes, syllabus, simulations, datasets, discussion threads. Conversely, any materials created solely by you (for example, your videos, essays, images, audio files, annotations, notes) are your intellectual property and you may use them as you wish.

RELIGIOUS ACCOMMODATION

UC Santa Cruz welcomes diversity of religious beliefs and practices, recognizing the contributions differing experiences and viewpoints can bring to the community. There may be times when an academic requirement conflicts with religious observances and practices. If that happens, students may request the reasonable accommodation for religious practices. The instructor will review the situation in an effort to provide a reasonable accommodation without penalty. You should first discuss the conflict and your requested accommodation with your instructor early in the term. You or your instructor may also seek assistance from the [Dean of Students office](#).

ALL-GENDER RESTROOMS

UC Santa Cruz is committed to the well-being of all students and cares about all students feeling safe and welcome, regardless of their gender identity, expression, and/or embodiment. The [Lionel Cantú Queer Center](#) has worked with students and campus staff to create more safe and accessible restrooms for transgender and genderqueer students, staff, faculty, alumni, and UCSC visitors. A [complete list of all-gender restrooms](#) on campus was compiled and is maintained by the Cantú Queer Center.

PRINCIPLES OF COMMUNITY

The University of California, Santa Cruz expressly prohibits students from engaging in conduct constituting unlawful discrimination, harassment or bias... [More here](#). I am committed to providing

an atmosphere for learning that respects diversity and supports inclusivity. We need to work together to build this community of learning. I ask all members of this class to:

- be open to and interested in the views of others
- consider the possibility that your views may change over the course of the term
- be aware that this course asks you to reconsider some “common sense” notions you may hold
- honor the unique life experiences of your colleagues
- appreciate the opportunity that we have to learn from each other
- listen to each other’s opinions and communicate in a respectful manner
- keep confidential discussions that the community has of a personal (or professional) nature
- ground your comments in the texts we are studying. Refer frequently to the texts and make them the focus of your questions, comments, and arguments. This is the single most effective way to ensure respectful discussion and to create a space where we are all learning together.

TITLE IX/CARE ADVISORY

UC Santa Cruz is committed to providing a safe learning environment that is free of all forms of gender discrimination and sexual harassment, which are explicitly prohibited under Title IX. If you have experienced any form of sexual harassment, sexual assault, domestic violence, dating violence, or stalking, know that you are not alone. The Title IX Office, the Campus Advocacy, Resources & Education (CARE) office, and Counseling & Psychological Services (CAPS) are all resources that you can rely on for support.

Please be aware that if you tell me about a situation involving Title IX misconduct, I am required to share this information with the Title IX Coordinator. This reporting responsibility also applies to course TAs and tutors (as well to all UCSC employees who are not designated as “confidential” employees, which is a special designation granted to counselors and CARE advocates). Although I have to make that notification, you will control how your case will be handled, including whether or not you wish to pursue a formal complaint. The goal is to make sure that you are aware of the range of options available to you and that you have access to the resources you need.

Confidential resources are available through [CARE](#). Confidentiality means CARE advocates will not share any information with Title IX, the police, parents, or anyone else without explicit permission. CARE advocates are trained to support you in understanding your rights and options, accessing health and counseling services, providing academic and housing accommodations, helping with legal protective orders, and more. You can contact CARE at (831) 502-2273 or care@ucsc.edu.

In addition to CARE, these resources are available to you:

- If you need help figuring out what resources you or someone else might need, visit the [Sexual Violence Prevention & Response \(SAFE\) website](#), which provides information and resources for different situations.
- [Counseling & Psychological Services \(CAPS\)](#) can provide confidential counseling support. Call them at (831) 459-2628.
- You can also report gender discrimination and sexual harassment and violence directly to the University’s [Title IX Office](#), by calling (831) 459-2462 or by using their [online reporting tool](#).
- Reports to law enforcement can be made to the UC Police Department, (831) 459-2231 ext. 1.
- For emergencies, call 911.

DIFFICULT CONVERSATIONS

In our in-class and online discussions and dialogues, we will have the opportunity to explore challenging, high-stakes issues and increase our understanding of different perspectives. Our conversations may not always be easy. We sometimes will make mistakes in our speaking and our listening. Sometimes we will need patience or courage or imagination or any number of qualities in combination to engage our texts, our classmates, and our own ideas and experiences. We will always need respect for others. Thus, an important aim of our classroom interactions will be for us to increase our facility with difficult conversations that arise inside issues of social justice, politics, economics, morality, religion, and other issues where reasonable people often hold diverse perspectives. This effort will ultimately deepen our understanding and allow us to make the most of being in a community with people of many backgrounds, experiences, and positions.

REPORT AN INCIDENT OF HATE OR BIAS

The University of California, Santa Cruz is committed to maintaining an objective, civil, diverse and supportive community, free of coercion, bias, hate, intimidation, dehumanization or exploitation. The Hate/Bias Response Team is a group of administrators who support and guide students seeking assistance in determining how to handle a bias incident involving another student, a staff member, or a faculty member. To report an incident of hate or bias, please use the following form: [Hate/Bias Report Form](#).

STUDENT SERVICES

[Counseling and Psychological Services](#)

Many students at UCSC face personal challenges or have psychological needs that may interfere with their academic progress, social development, or emotional wellbeing. The university offers a variety of confidential services to help you through difficult times, including individual and group counseling, crisis intervention, consultations, online chats, and mental health screenings. These services are provided by staff who welcome all students and embrace a philosophy respectful of clients' cultural and religious backgrounds, and sensitive to differences in race, ability, gender identity and sexual orientation.

[Student Success and Engagement Hub](#)

The Division of Student Success provides campus-wide coordination and leadership for student success programs and activities across departments, divisions, the colleges, and administrative units.

[Tutoring](#) and Learning Support

At Learning Support Services (LSS), undergraduate students build a strong foundation for success and cultivate a sense of belonging in our Community of Learners. LSS partners with faculty and staff to advance educational equity by designing inclusive learning environments in Modified Supplemental Instruction, Small Group Tutoring, and Writing Support. When students fully engage in our programs, they gain transformative experiences that empower them at the university and beyond.

[Slug Support Program](#)

College can be a challenging time for students and during times of stress it is not always easy to find the help you need. Slug Support can give help with everything from basic needs (housing, food, or financial insecurity) to getting the technology you need during remote instruction. To get started with SLUG Support, please contact the [Dean of Students](#) Office at 831-459-4446 or you may send us an email at deanofstudents@ucsc.edu.

Slug Help/[Technology](#)

The ITS Support Center is your single point of contact for all issues, problems or questions related to technology services and computing at UC Santa Cruz. To get technological help, simply email help@ucsc.edu.

On-Campus Emergency Contacts

Slug Help/[Emergency Services](#). For all other help and support, including the health center and emergency services, start [here](#). Always dial 9-1-1 in the case of an emergency.