Syllabus: SIO 119
Physics and Chemistry of the Ocean

Lectures:	Tuesday & Thursday	9:00-10:20	<Sumner 101 >
Discussion:	764636(A01) Tuesday	13:00-13:50	< Sumner 101 >
	764658(A02) Tuesday	14:00-14:50	< Sumner 101 >
	764663(A04) Wednesday	14:00-14:50	< Sumner 101 >
	764662(A03) Thursday	13:00-13:50	< Sumner 101 >

Instructors:

Ocean Chemistry: Professor Andreas Andersson (he/him)
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Office hours: Tuesday & Thursday after lecture or by appointment

Ocean Physics: Professor Uwe Send (he/him)
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Office hours: Tuesday & Thursday after lecture or by appointment

Teaching assistants:

Cheyenne Bridge (A01 and A04 discussions)
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Steven Flemig (A02 and A03 discussions)
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Office hours: TBD

Announcements and Course specific materials: Please consult Canvas

Course format: The class will mostly be in person. The exception is in Week 2 when lectures will be on Zoom only. All lectures will be recorded.

Objectives: This course will give you a brief introduction to some of the key elements of chemical and physical oceanography that influence marine biology and ecology. The course will draw on your prior background in physics, calculus, and chemistry to help you build specific understanding and skills that are pertinent to biology in the ocean. To understand biological properties and processes in the ocean it is critical to understand the physical and chemical environment in which they occur. In many instances, biology also has an influence on chemistry and physics so the need for understanding is bilateral. To the extent possible, the course will use an interdisciplinary approach to examine how ocean chemistry, physics and biology are intertwined, and will do so in the context of ongoing global environmental change (e.g., global warming, ocean acidification, deoxygenation, eutrophication). Lectures, discussion sections, weekly homework assignments, and exams will ask you to think and synthesize different material. The foundation of the class is not rooted in memorization, but rather to think critically and holistically on how different properties and processes in the

ocean are connected. Specifically, by the end of the course, you should have some understanding and be able to discuss:

Ocean chemistry:

- Origin of the universe, solar system and formation of elements
- Origin of the Earth, oceans and atmosphere
- Salt and gasses in the ocean
- Properties and controls of the marine CO_2 system
- Ocean carbon and $CaCO_3$ cycles
- Factors controlling C, O, N, and P in the ocean
- Basic redox reactions in marine environments
- Factors and links between acidification, deoxygenation and eutrophication
- Basics of radioactivity in the ocean

Ocean physics:

- Physical properties of seawater
- Property distributions in the ocean
- Light and sound in the ocean
- Basics of the ocean heat and freshwater budgets
- Forces driving motion in the ocean
- Locations and origin of major ocean currents
- Waves and tides
- Methods to observe ocean processes

Lectures: Lectures will be in person in Sumner 101 (at SIO). Students are expected to have completed the assigned readings before class to maximize their ability to learn the material. All lectures will be recorded.

Discussion sections: Weekly Discussion sections will be in person in Sumner 101. TAs will entertain questions relevant to assignments and lecture material. Part of the discussion may also be dedicated to completing a worksheet complementary to the lecture material and assigned readings.

Overlap with other classes: Some of the material in this class will overlap with material presented in other classes. There will be a range of feelings and opinions about this. Some students will appreciate the overlap as it gives them a chance to fully understand the material and perhaps view it in a different context while others will feel it is unnecessary repetition. No matter where you fall on this spectrum don't hesitate to reach out to any of the instructors and let us know if you feel under-stimulated as we are more than happy to provide additional in-depth material on any given topic. Similarly, if the material is challenging and you need additional help, don't hesitate to reach out to us.

Textbooks: There is no textbook for this class. Required readings from books, scientific articles or notes will be posted on Canvas.

Scientific articles: You will be assigned to read several scientific articles throughout the class. These will in general be short and focused on broad issues.

Computer software: As part of the class you will be asked to carry out a number of calculation exercises. To do this you will need access to CO2SYS. There is an Excel version available in the Week 2 module on Canvas. A matlab version is also available at this link: https://www.nodc.noaa.gov/ocads/oceans/CO2SYS/co2rprt.html)

Assignments: Homework assignments and quizzes will be assigned on a weekly basis. Late submissions are accepted until the solutions or correct answers have been posted on Canvas. A 5% scoring deduction will be applied for each day past the due date unless a justified and documented excuse has been provided.

Midterms: There will be two take-home midterms, one focused on ocean chemistry (Thursday, Feb 6) and one on ocean physics (Thursday, March 13). Midterms will be made available at 10am on these days and are due at 10am the following days. The lecture time slot is available to work on the midterm, and the instructors will be available at that time to answer questions.

Final exam project: Instead of a traditional Final Exam each student is asked to complete a final project focused on one aspect of Ocean-based Carbon Dioxide Removal and Sequestration (http://nap.edu/26278). Additional guidelines and requirements will be provided during the class, but each student will be required to record a 5 min presentation of their project and upload to Canvas.

Expectations: Students are expected to complete the following:

- Read assigned readings for both lectures and discussion sections each week
- Participate or view recordings of lectures and discussion section each week
- Complete weekly quizzes on Canvas
- Complete weekly problem set assignments
- Complete/look over weekly worksheet for discussion section
- Complete ocean chemistry midterm exam (take home, open book)
- Complete ocean physics midterm exam (take home, open book)
- Complete Final Project and present in 5 min recording (this replaces a final exam)

Grading: The main objective is that you learn something from this class. You will have the opportunity to demonstrate this by showing your knowledge and understanding during quizzes, assignments, midterm exams and a final project and presentation.

Quizzes	15%
Problem sets	20%
Midterm #1	20%
Midterm #2	20%
Final project	25%

Maintaining academic integrity: Academic Integrity is an important ethical principle at UCSD and an important part of your education. Please do not take it lightly. On Canvas there is a link on the left side to Academic Integrity Resources, we expect all students to review this section. We will occasionally ask you to sign a pledge to adhere to these principles.

All students are expected to do their own work. You are encouraged to discuss homework assignments and find solutions in groups, but each of you MUST write down your own solutions in your own words, annotation, and you MUST show your work. Please also cite which resources you followed/used for each solution, and acknowledge anybody whose input (e.g. discussion with whom) helped you most (it could have been a fellow student, a TA, or someone else).

Please be extremely aware that using online or commercial help/tutoring/solution services (for homeworks and exams) are not only grave violations of Academic Integrity but also that these services often are predatory and they have been known to come back and blackmail students. All this is explained in the AI section on Canvas. UCSD has excellent resources, also for tutoring, which you are encouraged to use.

We do not want to police your learning but create a fair learning environment, where "mastery" of the subject material is the goal, not achieving maximum "performance". Nonetheless, we need to evaluate your progress and learning, in a manner that is equitable to other students and upholds UCSD's standards. Therefore it is our profession and ethical obligation to uphold Academic Integrity and report Academic Integrity violations, following the UCSD principles at https://senate.ucsd.edu/Operating-Procedures/Senate-Manual/Appendices/2.

Discrimination and harassment

The University of California, in accordance with applicable federal and state laws and university policies, does not discriminate on the basis of race, color, national origin, religion, sex, gender, gender identity, gender expression, pregnancy (including pregnancy, childbirth, and medical conditions related to pregnancy or childbirth), physical or mental disability, medical condition, genetic information, ancestry, marital status, age, sexual orientation, citizenship, or service in the uniformed services (including membership, application for membership, performance of service, application for service, or obligation for service in the uniformed services). The university also prohibits harassment based on these protected categories, including sexual harassment, as well as sexual assault, domestic violence, dating violence, and stalking. The nondiscrimination policy covers admission, access, and treatment in university programs and activities.

If students have questions about student-related nondiscrimination policies or concerns about possible discrimination or harassment, they should contact the Office for the Prevention of Harassment & Discrimination (OPHD) at (858) 534- 8298, ophd@ucsd.edu, or reportbias.ucsd.edu. Campus policies provide for a prompt and effective response to student complaints. This response may include alternative resolution procedures or formal investigation. Students will be informed about complaint resolution options.

A student who chooses not to report may still contact CARE at the Sexual Assault Resource Center for more information, emotional support, individual and group counseling, and/or assistance with obtaining a medical exam. For off-campus support services, a student may contact the Center for Community Solutions. Other confidential resources on campus include Counseling and Psychological Services, Office of the Ombuds, and Student Health Services.

CARE at the Sexual Assault Resource Center - 858.534.5793 or sarc@ucsd.edu
Counseling and Psychological Services (CAPS) - 858.534.3755