

Syllabus: SIO 119 Physics and Chemistry of the Ocean

Lectures: Tuesday & Thursday 15:30-16:50 <Use Zoom link in Canvas>

Discussions:

27753	Wednesday	10:00-10:50	<Use Zoom link in Canvas>
27754	Wednesday	11:00-11:50	<Use Zoom link in Canvas>
27755	Friday	14:00-14:50	<Use Zoom link in Canvas>
27756	Friday	15:00-15:50	<Use Zoom link in Canvas>

Instructors:

Ocean Chemistry: Professor Andreas Andersson
Contact: Email: aandersson@ucsd.edu
Office hours: Tuesday & Thursday after lecture or by appointment

Ocean Physics: Professor Uwe Send
Contact: Email: usend@ucsd.edu
Office hours: Tuesday & Thursday after lecture or by appointment

Teaching assistants:

Benjamin Davis (Friday discussions)
Contact: Email: bddavis@ucsd.edu
Office hours: Tuesday 14:00-15:00

Taylor Hernandez (Wednesday discussions)
Contact: Email: tmhernan@ucsd.edu
Office hours: Monday 14:00-15:00

Grading: Letter or P/NP permitted

Announcements and Course specific materials: Please consult Canvas

Asynchronous: This class is asynchronous to accommodate student's individual circumstances. However, we strongly encourage synchronous participation to the extent possible to maximize learning.

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 these 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 gases in the ocean
- Properties and controls of the marine CO₂ system
- Ocean carbon and CaCO₃ 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 take place online at the scheduled lecture times. Students are expected to have completed the assigned readings before class to maximize their ability to learn the material. All lectures will be recorded. Breakout rooms may be organized for small-group interactions during the lectures.

Discussion sections: Weekly Discussion sections will take place online at the scheduled discussion times. TAs will entertain questions relevant to assignments and lecture material. Part of the discussion will also be dedicated to completing a worksheet in breakout rooms based on an assigned reading complementary to the lecture material.

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 (Excel version; <https://www.nodc.noaa.gov/ocads/oceans/CO2SYS/co2rprt.html>) or CO2calc (<https://pubs.usgs.gov/of/2010/1280/>).

Assignments: Homework assignments and quizzes will be assigned on a weekly basis.

Midterms: There will be two midterms, one focused on ocean chemistry (Tuesday, Feb 2) and one on ocean physics (Thursday, March 4). 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 instructor will be available at that time to answer questions.

Final exam poster project: Groups of approximately 6 students will be expected to create a poster, which takes the place of the final exam. The posters will be composed of segments, each contributed by one student, and the text for these segments must also be submitted individually for checking with Turnitin.com (see below). Posters will be graded both on overall (group) aspects (appearance/design, clarity of message, integration of components), and on the individual contributions by each student. In addition, students are expected to review and score some of their peer's posters. Posters will be presented during Finals week.

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 weekly worksheet for discussion section
- Complete ocean chemistry midterm exam (take home, open book)
- Complete ocean physics midterm exam (take home, open book)
- Work in a group to complete a poster addressing a topic where ocean physics, chemistry, and biology intersects (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 poster preparation and presentation.

Quizzes	15%
Problem sets	20%
Midterm #1	20%
Midterm #2	20%
Final exam poster	25% (10% group effort; 10% individual contribution; 5% review)

Maintaining academic integrity: Students agree that by taking this course all required papers will be subject to submission for textual similarity review to Turnitin.com for the detection of plagiarism. All submitted papers will be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. Use of the Turnitin.com service is subject to the terms of use agreement posted on the Turnitin.com site. This course will also adhere to the standard UCSD policy on academic

integrity: “Students are expected to do their own work, as outlined in the UCSD Policy on Integrity of Scholarship. Cheating will not be tolerated, and any student who engages in forbidden conduct will be subjected to the disciplinary process. Cheaters will receive a failing grade on the assignment or the exam and/or in the entire course. They may also be suspended from UCSD.” See <http://www-senate.ucsd.edu/manual/Appendices/app2.htm> for details.