

## Spring 2018 Syllabus

### MSL 660: Chemical Oceanography

Class meeting times: Tuesday and Thursday 09:45-11:15,

Location: 138 Irving II

Prerequisites: Graduate standing

3 credits

#### Instructor:

Dr. Andrew McDonnell

School of Fisheries and Ocean Sciences

231 Irving II

474-7529

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Office Hours: Tues., Thurs. 2-3 pm

**Course Description:** The course is an introduction to chemical oceanography, one of the four major fields of oceanography. We will examine the ocean as a chemical system in which the inputs, outputs, and internal cycling of the elements determine their concentrations and distributions within the ocean. The course will cover the role of fluxes across the ocean boundaries with the land, atmosphere, sediments and hydrothermal vents. We will then focus on the cycling of elements within the ocean, driven primarily by processes such as photosynthetic production, heterotrophic production, and the remineralization of organic matter. Chemical oceanography (like all oceanographic fields) is an essential part of the interdisciplinary knowledge necessary to understand the ocean. Students will be evaluated based on class participation, three homework assignments, two midterm exams, and a final exam.

#### Learning Objectives

1. Understand the roles of material input, output, and internal cycling of the chemical components in the ocean.
2. Identify physical, geological, chemical, and biological controls affecting the distribution and behavior of chemical species.
3. Become familiar with chemical oceanographic approaches to data collection and interpretation.
4. Understand and think critically about recent research in the field.

**Expected preparation for the course:** Undergraduate degree in science, or a background that includes similar undergraduate courses, is necessary. Competence in algebra is necessary; introductory calculus and differential equations are useful for some topics but are not required. One year of general chemistry and biology at the college level are necessary; organic chemistry, inorganic chemistry and biochemistry are helpful. Biological and physical oceanography are also helpful. If you have not taken a background course described as “helpful”, you will probably benefit from doing some extra reading to familiarize yourself with the basics. For example, an introductory general oceanography text will be useful for students who have not had this background.

<b>Grading:</b>	Class Participation	5 %
	Homework	25 %
	Midterm 1	20 %
	Midterm 2	20 %
	Final Exam	30%

Grades for each category above will be weighted according to the scale above in order to obtain an overall grade out of a possible 100%. There will be no extra credit assignments. Your overall grade will be rounded to the nearest whole percentage before final grades are assigned. Only whole letter grades will be assigned (no plus (+) and minus (-) grading system).

≥90 % = A  
80-89 % = B  
70-79 % = C  
60-69% = D

≤ 59 % = F

**Text:**

Libes, S.M., 2009. *Introduction to Marine Biogeochemistry*, Second Edition. Academic Press (electronic version available for free on the UAF library website)

Assigned readings from other texts/articles will be provided in class or via the library.

Additional texts you might find useful:

- Sarmiento, J. L., and N. G. Gruber. 2006. *Ocean Biogeochemical Dynamics*. Princeton University Press.
- Pilson, M.E.Q. *An Introduction to the Chemistry of the Sea*, 2nd Edition

**Course Policies:** Lecture attendance and active participation in class is expected from all students. If you must be absent due to illness, field work, or other important reasons, please notify the instructor in advance (if possible) and arrange to make up missed material or assignments.

E-mail communication will be used to distribute class information, updates and changes.

Lack of academic integrity including plagiarism is not acceptable and will not be tolerated. See the UAF Student Code of Conduct

**Homework**

Collaboration among students is encouraged. However, each student is expected to submit their own work.

Homework assignments will not be accepted after the due date, unless arrangements have been made in advance with the instructor.

**Exams.** There will be two midterms. The final exam will be administered on Friday May 3, 2018 from 08:00-10:00. Exams will require short-essay and diagramed answers, with some problem solving. All exams will be closed-book. The final exam will be comprehensive with a slight emphasis on material covered after the second midterm.

**Support and Disability Services:** At UAF, the Office of Disability Services (203 WHIT; 474-5655; TTY 474-1827; [fydso@uaf.edu](mailto:fydso@uaf.edu)) ensures that students with physical or learning disabilities have equal access to the campus and course materials. If you have specialized needs, please contact this office or the instructor to make arrangements.

Date	Learning Objectives	Reading (Libes)
1/16	Introduction	Chapter 1
1/18	The ocean as a chemical system	Chapter 2
1/23	AMSS (no lecture, Physical properties and circulation)	Chapter 4
1/25	AMSS (no lecture)	
1/30	Major ions/Chemical transformations	Chapter 2
2/1	Atmosphere-seawater interface and Gas exchange	Chapter 6
2/6	Redox reactions	Chapter 7
2/8	Distribution of Elements in the Ocean	
2/13	OCEAN SCIENCES (No lecture)	

2/15	OCEAN SCIENCES (No lecture)	
2/20	Production and respiration	Chapter 8
2/22	Nutrient distributions	
2/27	Nutrient distributions	Chapter 10
3/1	Nitrogen cycle I	Chapter 24
3/6	Nitrogen cycle II/Phosphorous cycle	
3/8	<b>MID-TERM EXAM #1</b>	
3/13	<b>SPRING BREAK</b>	
3/15	<b>SPRING BREAK</b>	
3/20	Silicon cycle	Chapter 16
3/22	Hydrothermal vent systems	Chapter 20
3/27	Trace elements I	Chapter 11
3/29	Trace elements II	Chapter 5.7
4/3	Inorganic carbon chemistry	Chapter 15
4/5	Marine carbon cycle I	Chapter 15
4/10	Marine carbon cycle II	Chapter 15
4/12	Dissolved and particulate organic matter cycling	Chapter 23
4/17	<b>MID-TERM EXAM #2</b>	
4/19	Sediment burial and diagenesis	Chapter 12
4/24	Sediment burial and diagenesis	Chapter 20
4/26	Isotope geochemistry	
4/30	The effects of global change on marine chemistry	Chapters 24.9 & 25
5/3	<b>FINAL EXAM (8-10 am)</b>	