



CHEM F631

Fate and Transport

Spring 2020

CRN: 36365 or 36431, 3 credits

Lecture: REIC 204, 915am MWF



Instructor: Jennifer Guerard, Ph.D.

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Office Hours: Wed 10:30 – 12:00 pm

Course Catalog Description. Examination of the physical properties that govern the behavior, fate and transport of contaminants released into the environment. Topics include air-water partitioning and exchange, organic solvent-water partitioning, diffusion, sorption, chemical and biological transformation reactions, and modeling concepts.

Course Materials

Textbook. *Environmental Organic Chemistry* third edition (2017) by R.P. Schwarzenbach, P.M. Gschwend and D.M. Imboden. **ISBN: 978-1-118-76723-8**

Other materials. A scientific calculator and/or Excel will be essential for doing problem sets and exams.

Important Dates.

Jan. 13th First day of class

Jan. 24th: Deadline for adding classes, late registration, faculty-initiated drops.

Last day to drop with no appearance on academic record

Feb 17th: Exam I

Mar. 27th: Last drop date with W/Faculty initiated withdrawals.

Mar. 23rd: Exam II

Apr. 27th: Last day of instruction

Apr. 29th : FINAL EXAM, 8:00 am – 10:00 am

Course Goals. This course is designed to teach students how to determine what happens to a compound when released into the environment. We will focus on organic compounds, but the principles applied to the organic compounds can also be applied to inorganic compounds.

Student-Learning Outcomes. Broadly, students will become familiar with principles and techniques used to quantitatively describe the behavior, fate, and transport of chemicals released into the environment, including phase transfer, partitioning, adsorption, and transformation of environmental contaminants. At the end of the course, you should be able to perform an assessment to predict the fate of any compound released into the environment, and be able to critically review current research literature in fields of environmental fate and transport.

Course Structure. The coursework will follow the textbook as described on the Tentative Lecture Schedule. The instructor will lecture on the theoretical aspects of organic chemistry, using a combination of slides and whiteboard, providing copies of notes to the students via Blackboard. The instructor will make every attempt to record lectures and provide them on Blackboard via Kaltura.

Evaluation and Grade Assignment

Point Breakdown.

Homework (10 pts each)	100 points
EXAM 1 (Feb. 17 th):	100 points
EXAM II (Mar. 23 rd):	100 points
Article Reviews (25 pts each)	50 points
Lit Rev. (see posted rubric)	150 points
Final Exam	100 points
Total Course Points:	600 points

Grading.

A =	≥ 90%	(≥ 540 points)
B =	80 – 89%	(480 – 539 points)
C =	70 – 79%	(420 – 479 points)
D =	60 – 69%	(360 – 419 points)
F =	< 60%	(< 360 points)

I may elect to lower the grade point cutoffs, but will not raise them. I will not be using +/- grading.

Notes and Policies

Homework. Homework assignments are listed on the tentative course schedule in this syllabus and are due by the start of class on the days listed. **Late assignments are not accepted.** Homework is a very important component of this class! You must practice using the concepts and doing the mathematics required to solve environmental problems to do well in the course. The homework problems provide you with an opportunity to learn how to approach a problem and the mechanics of actually doing the problem. Homework can be emailed or turned in directly.

I encourage you to work in groups to solve the homework problems and stop by office hours. However, your work must be your own - just copying someone else's solution violates the Honor Code (see below).

Exams. Exams will consist of a portion of in-class and/or out-of-class exams. For in-class exams, no resources are allowed during exams other than a non-programmable scientific calculator and the textbook. You must turn in your exam before leaving the room. *Use of cell phones or electronic devices other than a non-programmable scientific calculator during exams constitutes cheating and will result in an F in the course as per the policy of the Chemistry Department (see Honor code).* For out-of-class exams, you are allowed to use the textbook, available scientific literature, and computational methods of your choice (Excel, calculator, Matlab, etc.), but are not allowed to confer with others apart from the instructor.

Make-up exams are only allowed in the event of a legitimate excuse as determined by the instructor. If you anticipate an absence from an exam, bring it to my attention *before* the exam date, or in the case of unexpected absences, within one business day.

Honor Code. Chemistry Department policy states that any student caught cheating on graded work will be assigned a course grade of F. Course drop forms will not be signed in these cases.

Instructor-Initiated Withdrawals. Until **Friday, March 27th**, the instructor has the right to withdraw a student who has not participated substantially in the course. Any of the following constitute non-participation: 1) Exam I missed without an excused absence, 2) At least 2 incomplete homework assignments.

Office Hours. I encourage you to come visit during office hours! Ask questions about homework, assignments, concepts, etc. I generally keep an open-door policy, so feel free to ask if I am available or email me to schedule a time conducive to both of our schedules.

Article Reviews (2). Two 1-2-page critical reviews of published journal articles of your choice will be required during the term (see Tentative Schedule). Selected articles to review must be submitted to the instructor by Feb 10th. These are described briefly below, and more details will be presented in class/posted on Blackboard.

- The first review is a guided analysis of a “Critical Review” from the journal *Environmental Science & Technology (ES&T)* within the past 5 years and is due Feb. 28th
- The second review is due March 30th, reviewing a research article from *ES&T* within the past 5 years as if you were a peer reviewer for the journal.

Literature Critical Review Paper. Choose a topic of interest concerning partitioning, transport, or transformation in the environment. Proposed titles are due Jan. 24th and an annotated bibliography of at least 10 references is due Feb 14th. There are two major writing assignments associated with this project described briefly below, and more details will be presented in class/posted on Blackboard.

- An *ES&T* style “scientific opinion” is due Mar. 6th (see example posted on Blackboard). This is intended to be a short form survey of literature about your chosen topic and designed to help you organize cited references and discuss them in the context of the points about your topic. These assignments will be shared with another student in the course for peer review. You will be expected to participate in peer-review of student papers, with a written peer review due Mar 20th. Format Requirements: 700 – 1000 words (not including references). References (at least 10) should follow *ES&T* journal format.
- Due Apr 24th, this paper will expand upon the first assignment, critically reviewing the state of the science of your chosen topic. Briefly, the paper should concisely introduce the chosen topic and its broader environmental context. The body of the paper should discuss the issues in the context of environmental partitioning, transport, or transformation, providing a review of information from the literature relevant to “understanding” environmental fate and transport. Your paper should provide a *critical* assessment of the literature on your topic, and conclude with suggestions for future investigations. Format Requirements: At least 2500 words (not including references; aim for 10-15 pages double spaced). References (at least 15) should follow *ES&T* journal format. You will be required to present a short synopsis of your critical review on Apr 27th (8-min presentation).

Student Protections and Services Statement. Every qualified student is welcome in my classroom. As needed, I am happy to work with you, disability services, veterans' services, rural student services, etc. to find reasonable accommodations. Students at this university are protected against sexual harassment and discrimination (Title IX), and minors have additional protections. As required, if I notice or am informed of certain types of misconduct, then I am required to report it to the appropriate authorities. For more information on your rights as a student and the resources available to you to resolve problems, please go the following site: www.uaf.edu/handbook/. **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: 361-6370. **Disabilities Services.** The Office of Disability Services implements the Americans with Disabilities Act (ADA), and ensures that UAF students have equal access to the campus and course materials. I will work with the Office of Disabilities Services (*208 Whitaker, 474-5655) to provide reasonable accommodation to students with disabilities. **Student Support Services.** The Student Support Services (SSS) program (trio.sss@alaska.edu), located in 512 Greuning (474-6844), provides opportunities for academic development, assists students with college requirements, and serves to motivate students toward successful completion of their degree programs. For more information: 474-6844 www.uaf.edu/sssf/

Amending this Syllabus: Before the drop date, I may revise the syllabus to correct for any errors. Revision at a later time would require majority vote by students present in class on day issue is decided. Adjustments to the lecture schedule and homework due dates may be made at the instructor's discretion anytime during the semester. Any revisions will be distributed via Blackboard and announced in class.

Tentative Lecture Schedule					
Wk	Date	Topic	Reading	Assignments	
1	M 1/13	Chem & Thermo Review	Ch 1-3 – Intro, Review	HW 1 assigned	
	W 1/15		Ch 4 – Thermo, Fugacity		
	F 1/17		Ch 4 – Activity, Van't Hoff	HW 2 assigned	
2	W 1/22	Chem & Thermo Review	Ch 4 – Acidity	HW 1 due	
	F 1/24		Ch 4 – Hammett Relationships	Lit. Rev. Title Due	
3	M 1/27	Partitioning	Ch 7 – Partitioning, LFERs	HW 3 assigned	
	W 1/29		Ch 8 – Phase transitions	HW 2 due	
	F 1/31		Examples & Problems		
4	M 2/3	Vapor Pressure	Ch 8 – Estimating pi*	HW 3 due	
	W 2/5		Ch 9 – Activity	HW 4 assigned	
	F 2/7		Examples & problems		
5	M 2/10	Solubility	Ch 9 – Henry's Law	Article Rev. Titles Due	
	W 2/12		Ch 9 – Influences (T, I, pH)		
	F 2/14		Examples & problems	Annotated Bibliography due, HW 4 due	
6	M 2/17	Org liquid-air and water partitioning	EXAM 1 – Ch 1-9		
	W 2/19		Ch 10 – Kow, LFERs	HW 5 assigned	
	F 2/21		Ch 10 - Mixtures		
7	M 2/24	Surface Interactions	Ch 11 - Surfaces, sorption	HW 6 assigned	
	W 2/26		Ch 12 – Kd		
	F 2/28		Examples & Problems	1 st Article Rev. due	
8	M 3/2	NOM Sorption	Ch 13 – NOM, Koc	HW 5 due, HW 7 assigned	
	W 3/4		Ch 13 – Acids & Bases Sorption		
	F 3/6		Examples & Problems	ES&T style sci opinion due	
SPRING BREAK NO CLASS					
9	M 3/16	Ion Exchange	Ch 14 – Ion Exchange	HW 6 due	
	W 3/18		Ch 14 – Surface Complexation		
	F 3/20		Examples & Problems	Peer Revs. Due, HW 7 due	
10	M 3/23	Aerosols	Exam II (Ch 10-14)		
	W 3/25		Ch 15 – Aerosol Partitioning	HW 8 assigned	
	F 3/27		Ch 16 – Bioaccumulation	HW 9 assigned	
11	M 3/30	Bioaccumulation	Ch 16 – Bioaccumulation/Toxicity	2 nd Article Rev. due	
	W 4/1		Examples & Problems		
	F 4/3		Ch 21 – Organic Transformations		
12	M 4/6	Hydrolysis & Redox	Ch 22 – Hydrolysis	HW 8 due	
	W 4/8		Ch 23 – Redox		
	F 4/10		Examples & Problems		
13	M 4/13	Photolysis	Ch 24 - Direct Photolysis	HW 10 assigned	
	W 4/15		Ch 24 – Direct Photolysis	HW 9 due	
	F 4/17		Examples & Problems		
14	M 4/20	Mediated Transformations	Ch 25 – Indirect Photolysis		
	W 4/22		Ch 26 - Biotransformations	HW 10 due	
	F 4/24		Examples & Problems	Final Paper due	
15	M 4/27		Student Presentations		
	W 4/29		FINAL EXAM (Ch 15-26) 8:00 am – 10:00 AM		