E536 Environmental Chemistry
Fall 2024
SYLLABUS

Instructors. Your instructor is Prof. Jonathan Raff. Contact him via e-mail at jdraff@indiana.edu. Please address all grade and administrative related correspondence to Prof. Raff via email and allow up to 2–3 days for response. Your associate instructor (AI) for the course is Zack Vajda; his e-mail address is zbvajda@iu.edu.

Lectures. The class will meet for in-person lectures on Mondays and Wednesdays from 1:15–2:30 pm EST in room PV A201. Recorded lectures will be posted to Canvas (under the relevant course module) as soon as they have been processed. These videos are for you to view if you need to check your notes or if you were ill and had to miss a class. They should not be a substitute for attending class and for taking notes. Attendance and participation in lectures is mandatory unless you are ill (see below). Students are welcome to wear masks that fully cover nose and mouth while in the classroom (see Canvas site for more information).

Learning Assistance. Instructors will offer live office hours via Zoom at times to be determined. Instructions on how to join will be provided on Canvas. We will also make use of the Discussions feature of Canvas to field questions about homework problems, course material, and provide answers.

Prerequisites. One general chemistry class that includes a laboratory.

Textbooks. We will use the following IU eText: Raff & Hites, *Elements of Environmental Chemistry, 3rd edition*, Wiley, 2020. That means you will not need to purchase a textbook on your own. The charge for the eText is posted as a Course Fee to your Bursar account and then added into your first bill for the term. The eText version will save you money. However, if at some point you would like to purchase a hardcopy of the book the ISBN is 978-1119434870 (*Make sure you get the 3rd edition*). For a review of general chemistry concepts the following texts are recommended, but not required: *General Chemistry* by Linus Pauling (Dover Books), or any college-level general chemistry book.

Participation/Absences. Attendance and participation in in class are mandatory. I cannot overstate the importance of attending the class and taking notes *with a pen and notebook*. The class will provide you with problem solving skills, exposure to current topics of environmental chemistry, and will form a solid foundation for other environmental science classes that are part of the MSES and PhD programs. Office hours will help reinforce what you learned in class and will provide you with help solving homework problems and preparing for the exams. That being said, with the ongoing COVID-19 pandemic, we realize that some students may fall ill and be unable to keep up for an extended period in the fall due to illness. If you are ill, have a positive COVID-19 test, have COVID-like symptoms, or have been instructed to quarantine you should not attend class. If you are ill are unable to work on course material for an extended time, please contact Prof. Raff. Outside of approved accommodations for illness related to COVID-19, there will be no make-up assignments or exams, and due dates are *non-negotiable*.

Course Drop Policy. It is the student's responsibility to know about the deadlines for dropping E536; please see the official academic calendar on the IU Registrar's webpage or your student handbook for deadlines. Dropping the class after the official deadline will result in a grade of "W" (withdrawal) unless the student qualifies for an incomplete ("I"). Please note that according to the official Academic Guide, "The grade of Incomplete may be given *only* when the completed portion of a student's work in the course is of passing quality." This policy will be strictly followed. Please note that the auto-W deadline is no longer the last day of class as it was during and post-COVID. After the auto-W deadline, withdrawal will be significantly limited and you will need permission to withdraw and must meet requirements established by O'Neill, as discussed above.

Problem Sets. There will be seven problem sets; each should take ~6 hours to complete. The problem sets are comprised of the following exercises found at the end of the indicated chapters:

PS #1 *Ch. 1*: 1-5, 7-11, 13, 15, 20
PS #2 *Ch. 2*: 3-5, 7-11, 13, 15, 16, 18, 21-23
PS #3 *Ch. 3*: 2-6, 9,11, 12, 15, 16
PS #4 *Ch. 4*: 1, 3–7, 9, 11, 14, 15, 18, 21
PS #5 *Ch. 5*: 1, 3, 5, 7-9, 11, 12, 14, 17, 18, 19, 20; *Ch. 4*: 8
PS #6 *Ch. 6*: 1-5, 7-9, 12, 14, 17, 22
PS #7 *Ch. 1*: 16, 17, 21, 22; *Ch. 6*: 10, 11, 14, 16, 17, 20

Answers are provided in Appendix B of the textbook and video solutions to each problem will be provided on Canvas after you've had some time to work on them. Your completed problem should be uploaded onto Canvas as a *.pdf by the dates given below and listed on Canvas. Please note that we will not be grading these problem sets; credit will be given for completeness. Students are encouraged to form study groups and work on the problems sets collaboratively, but remember that you will be tested on your individual understanding of the material in the exams, so make sure you do all the problems yourself to internalize and master the problem solving skills presented in each exercise. Office hours and Discussions via Canvas will provide students with an opportunity to discuss solutions and strategies to solve assigned problems with the guidance of the Instructors.

Group Projects. There will be five group projects that will provide students working in groups with an opportunity to apply their skills to a real-world environmental chemistry problem. Each person in a group (3 person limit) will be given the same grade. Groups should mutually agree upon a work distribution at the start of each project. Although this is rare, any issues with group members not participating equally in group work should be reported to Prof. Raff as soon as possible. Students found not contributing to their group may receive a lower grade for the assignment. Group projects should be uploaded as a *.pdf on Canvas and will be due at the same time as the indicated problem sets (see below). The Projects are found at the end of chapters as indicated:

Group Project #1 *Ch. 2*: #27 (due with PS #2)
Group Project #2 *Ch. 3*: #22 (due with PS #4)
Group Project #3 *Ch. 5*: #23 (due with PS #5)
Group Project #4 *special instructions* (due with PS #6)
Group Project #5 *science writing project* (due with PS #7)

You may form your own groups of no more than three (3) people. If you would prefer to be assigned a group, please contact the AI for assistance.

Exams. There will be three take-home exams that are to be completed individually. You are not allowed to collaborate with anyone or seek help from anyone to complete the exam. You will have 7 days to complete each exam and submit it (upload as *.pdf) onto Canvas. Exams are in principle cumulative, although the most recent material will be emphasized. In addition, the exams will get a little more difficult with time. Exams will be based on the problem sets and the example problems found in *Elements of Environmental Chemistry, 3rd edition*, in addition to material covered in the lecture. Although the problems that appear in the Exams will not be identical to those you did in the homework, they will rely on similar skills you developed with your homework exercises. In addition, to testing your quantitative skills, exams may also include qualitative/short answer questions meant to test your understanding of concepts.

Grading. The final grade will be based on the following 3 activities: Take home exams, the average of the seven problem sets and group projects. The contribution of each assignment to the grade is as follows:

Take-home exams (3):	60%
Problem Sets (7):	25%
Group Projects: (5)	15%

The full array of plus and minus grades will be used for the final grade. The instructor reserves the right to curve the final grades. In all grading, neatness will count so show all work clearly to explain to the grader how you derived the answer.

Course Professionalism Policy. Students are expected to uphold and maintain academic and professional honesty and integrity, as outlined in IU's Code of Students Rights, Responsibilities and Conduct (please see: https://studentcode.iu.edu/). In addition, the O'Neill Student Honor Code may be found at: https://bulletins.iu.edu/iu/spea-ugrad/2021-2022/policies/school-standards.shtml. Violations of The Code include the intentional use of unauthorized study aids, equipment, or another person's work during an exam, allowing or facilitating another student to cheat from you, copying assignment answers from any unapproved source (e.g., another student, answer keys, etc.), and presenting someone else's work as one's own (plagiarizing). Please consult with the instructor if you are unsure of what constitutes plagiarism. In addition, carrying out the following activities during class time are unacceptable: Cellular phone use, including texting; arriving late for class or leaving class early (unless agreed upon by instructor beforehand); accessing email or surfing the web during class; working on material for another course during class.

Use of AI (such as ChatGPT). Using artificial intelligence (AI, such as ChatGPT) to assist in completing assignments in this class is prohibited. If you do use AI, you will be committing plagiarism (see above for a definition) and will be subject to penalties in this class and sanctions by Indiana University.

Additional Information

1. *Adapting to Online Learning*. IU has created the KeepLearning.iu.edu website to help students move to the online environment. If you run into technical problems along the way, please contact the UITS Support Center (812-855-6789; ithelp@iu.edu) for technical help 24 × 7. If you have internet connectivity problems you might consider emailing vpsa@indiana.edu, the division of student affairs. They apparently have some mobile hotspots to distribute.

2. *Counseling and Psychological Services*. For information about services offered to students by CAPS: http://healthcenter.indiana.edu/counseling/index.shtml. CAPS also offers online services. Students may schedule 30-minute virtual visits with a counselor by calling 812-855-5711. The crisis line is available to students 24/7 by calling 812-855-5711 and choosing option 1. In addition, you should know that IU students have free, 24/7 access to virtual mental health care services with TimelyCare. Students do not need insurance to access TimelyCare services. See: https://www.iu.edu/mental-health/find-resources/timely-care.html#0

3. *Access Journal articles* via the following link:

https://kg6ek7cq2b.search.serialssolutions.com/ejp/?libHash=KG6EK7CQ2B#/?language=en-US&titleType=JOURNALS.

Major databases can be found on the Sciences Library website:
https://libraries.indiana.edu/sciences-library

VPN is not required to access these resources and should not be used to help from overloading the VPN. The most useful databases for searching for peer-reviewed literature in the environmental chemical sciences is: SciFinder Scholar and Web of Science, both offered through the Science Library website above.

4. *Note Selling:* Several commercial services have approached students regarding selling class notes/study guides to their classmates. Selling the instructor's notes/study guides in this course is not permitted. Violations of this policy will be reported to the Dean of Students as academic misconduct (violation of course rules). Sanctions for academic misconduct may include a failing grade on the assignment for which the notes/study guides are being sold, a reduction in your final course grade, or a failing grade in the course, among other possibilities. Additionally, you should know that selling a faculty member's notes/study guides individually or on behalf of one of these services using IU email, or via Canvas may also constitute a violation of IU information technology and IU intellectual property policies; additional consequences may result.

5. *Online Course Materials*: The faculty member teaching this course holds the exclusive right to distribute, modify, post, and reproduce course materials, including all written materials, study guides, lectures, assignments, exercises, and exams. While you are permitted to take notes on the online materials and lectures posted for this course for your personal use, you are not permitted to re-post in another forum, distribute, or reproduce

content from this course without the express written permission of the faculty member. Any violation of this course rule will be reported to the appropriate university offices and officials, including to the Dean of Students as academic misconduct.

6. *Sexual Misconduct & Title IX*: As your instructor, one of my responsibilities is to create a positive learning environment for all students. IU policy prohibits sexual misconduct in any form, including sexual harassment, sexual assault, stalking, sexual exploitation, and dating and domestic violence. If you have experienced sexual misconduct, or know someone who has, the University can help. If you are seeking help and would like to speak to someone confidentially, you can make an appointment with the IU Sexual Assault Crisis Services at (812) 855-5711, or contact a Confidential Victim Advocate at (812) 856-2469 or cva@indiana.edu. It is also important that you know that University policy requires me to share certain information brought to my attention about potential sexual misconduct, with the campus Deputy Sexual Misconduct & Title IX Coordinator or the University Sexual Misconduct & Title IX Coordinator. In that event, those individuals will work to ensure that appropriate measures are taken and resources are made available. Protecting student privacy is of utmost concern, and information will only be shared with those that need to know to ensure the University can respond and assist. I encourage you to visit http://stopsexualviolence.iu.edu/index.html to learn more.

7. *Miscellaneous.* It is not possible to foresee every kind of circumstance that may arise during the semester. Consequently, I reserve the right to handle any situation as I see fit. Also note, this syllabus is only a guide. Any changes or adjustments will be documented through Canvas announcements.

E536 Course Calendar–Fall 2024

Date	#	Topic	Pre-lecture prep.*	Items Due
August				
21	1A	Estimation	1-5	…
23	1B	Ideal Gas Law, Unit conv.	6-16	…
28	1C	Stoichiometry		
30	1D	Thermodynamics	23-33	…
September				
4	2A	Flows and s.s. mass balance	23-33	PS#1
6	2B	fluxes and s.s. mass balance	34-40	…
11	2C	Non-steady state mass balance	41-52	…
13	2D	Chemical kinetics part I	52-69	…
18	2E	Chemical kinetics part II	"	…
20	2F	Enzyme kinetics	64-69	…
25	3A	Atmospheric chemistry		PS#2
27	3B	Atmospheric chemistry	77-86	…
October				
2†	3C	Atmospheric chemistry	80-86, 105-112	Exam #1
4†	3D	Atmospheric chemistry	91-99	…
9†	4A	Chemistry of climate change	100-104	…
11	4B	Chemistry of climate change	123-134	PS#3
16	4C	Chemistry of climate change	134-141, IPCC Summary	…
18	5A	CO_2 equilibria	141-146, IPCC Summary	PS#4 10/20
23	5B	CO_2 equilibria	151-165	
25	5C	Acid Rain and Reactivity	165-172	…
30	5D	Ocean Acidification	174-181	…
November				
1	6A	Fates of organic chemicals	"	PS#5
6	6B	Fates of organic chemicals		
8	6C	Fates of organic chemicals		Exam #2
13	6D	Fates of organic chemicals	223-228, Appendix A	…
15	7A	Legacy Pesticides		PS#6 (due 20-Nov)
20		*Thanksgiving Break - no class*	229-235, 235-240	…
22		*Thanksgiving Break - no class*	240-270	
27	7B	Measurement Issues	190-199, Appendix A	
29	7C	Current Use Pesticides	200-210	
December				
4	7D	Toxic Metals	210-217	…
6	7E	PCBs, Dioxins, PBDE, PAH	259-306	PS#7
13		Take home exam #3 due		Exam #3

* Page numbers are for reading from the required textbook, *Elements of Environmental Chemistry, 3rd ed.* by J. D. Raff & R. A. Hites. Please have this reading done before you attend class. In addition to reading, please watch any videos posted in the Canvas module for each lecture.

† Denotes tentative days when we will not meet in person. However, you will be responsible for viewing pre-recorded video and for turning in any assignments on this day. Instructor will confirm dates in class.