Environmental Chemistry **University of Mary Washington**
Chem331 **Spring 2019**

Lecture: MWF (10:00 - 10:50) (Jepson 219)

Instructor: Prof. Charles Sharpless Jepson 341 (654-1405) csharple@umw.edu

Office Hours Walk-in: MWF (11-12), T (10-12) Appointments also welcome!

Text: Principles of Environmental Chemistry, 3rd Ed., JE Girard, (Jones and Bartlett, Pub.)

Course Website: https://canvas.umw.edu/login

General Education and Course-Specific Learning Objectives

This course in part satisfies the Global Inquiry General Education requirement. After completing the course, you should be able to:

- express an understanding of the global connections between chemical cycles and human activities
- explain how chemical theories are applied to understand and model global processes and systems
- reflect upon how global relations affect the flow of chemical systems in the environment in ways that impact your life and the lives of others

This course is designed as an introduction to chemical processes in earth's environment. We will use basic chemical principles to understand the chemistry of the atmosphere, water, and subsurface. A major focus will be the ways that natural systems are perturbed by human actions on local and global scales, such as energy use, agriculture, and industry. We will also examine equilibrium approaches to predicting the fate of persistent organic chemicals. Through this course, you will gain (1) a qualitative and quantitative understanding of the major chemical processes controlling the global cycling of materials and energy through the environment, (2) an appreciation of how natural chemical systems are altered by anthropogenic influences, and (3) a familiarity with processes affecting the sources and fate of environmental contaminants.

Prerequisites: To succeed in this course, you must have completed college-level general chemistry. In Chem331, we will encounter topics from physical, organic, and analytical chemistry, but you need not have previously taken these courses. Some assignments will require you to perform spreadsheet calculations and graphing using programs such as Microsoft Excel, and prior experience with this, although not necessary, will prove useful.

Grading:		
	Practice problem sets	25%
	Attendance	10%
	In-class work for greenhouse module	15%
	Exams (best 3 of 4)	50%

Students with a grade of C or below on 3/15 will receive a mid-semester deficiency report.

Practice Problem Sets: There will be eight or nine practice problem sets assigned throughout the semester. These are not graded per se, but thorough completion and submission of them will count towards 25% of your grade. Incomplete problem sets will be awarded credit based on their level of completeness. The problem sets are representative of the types of problems you may encounter on exams or in real-life situations where you are asked to assess environmental chemistry data. To be able to pass the exams, it is essential that you do these problem sets. Answer keys will be available on the dates that they are due.

Exams: There will be four closed-book exams (50 minute), the fourth of which will be given during final exam week. Exam dates are given in the weekly schedule below. Your best three exam grades will count towards your course grade. Review sheets will be posted on Canvas. Any necessary equations and constants will be provided. Missed exams may not be made-up. Should you know or suspect in advance that you will miss an exam, you must contact me to make appropriate arrangements.

Greenhouse Module: The last two weeks of class will be built around online modules on climate change developed by the American Chemical Society (ACS). We will use class time to go into extra depth on earth's energy balance, the physical basis of the greenhouse effect, radiation balance in a layered atmospheric model, and radiative forcing by greenhouse gases. To reinforce the material, there will be in-class problem set work, and 15% of your course grade is based on your completing the problem sets and making meaningful contribution to associated discussions and Q&A sessions. If you'd like a sneak preview of the material, the modules we will be using can be found at https://www.acs.org/content/acs/en/climatescience.html.

Assigned Readings: Most readings will come from the required text by James E. Girard, abbreviated below as JEG. Other readings will be assigned for the special topic and will be posted on Canvas. The lectures do not follow the readings exactly, and you should do the reading before coming to lecture so that you are prepared to engage meaningfully in class and address questions you may have about differences between the text's approach and mine.

Attendance: Attendance will count as 10% of your course grade. In order to succeed in this class you must attend lecture, because lecture time will be used to thoroughly examine topics that are summarily covered in assigned readings. Absences due to illness are understandable, but should you know in advance that you will be absent, I would appreciate an email informing me. Regardless of the reason, you should obtain lecture notes from a fellow student or me and check with me to make sure you understand the notes.

Disability Resources Students who require or feel they may require accommodations due to a disability should visit the Office of Disability Resources, http://academics.umw.edu/disability/. A detailed accessibility statement can be found here: https://tinyurl.com/331DRS19.

Honor System In accordance with the University's Honor Code, all work submitted for grading must be your own and be pledged as such by writing at the end of the work, *"I hereby declare upon my word of honor that I have neither given nor received any unauthorized help on this work. (your signature)".* It is your duty as students and mine as faculty to uphold the Honor Code, which is described in detail in the Guidebook & Constitution (https://tinyurl.com/UMWHC). Suspected violations of the Honor Code will be addressed according to the policy established by the Honor Council.

Classroom Recordings Classroom activities in this course may be recorded by students enrolled in the course for the personal, educational use of that student or for all students presently enrolled in the class only. More policy details are at https://tinyurl.com/331CRS19.

Title IX Statement UMW is committed to supporting students and upholding the University's Policy on Sexual and Gender Based Harassment and Other Forms of Interpersonal Violence. Under Title IX and this Policy, discrimination based upon sex or gender is prohibited. If you experience an incident of sex or gender based discrimination, we encourage you to report it. You may talk to me, but understand that as a "Responsible Employee" of the University, I must report to UMW's Title IX Coordinator what you share. More information can be found at https://tinyurl.com/331TNS19.

Chem331 Weekly Course Schedule (Spring 2019, subject to change)

*Readings from JEG unless noted. Where marked with * Appendix D in the text may be helpful*

Week Of	Topic	Readings
Jan 14th	Introduction to environmental chemistry	pp 2-14, 18-22 *Bullough's Pond*, Ch 15 (download from Canvas)
Jan 21st	*No class Monday – MLK Day* Energy use and fossil fuels	Ch 11*
Jan 28th	Energy use and fossil fuels The atmosphere, CO_2 and the greenhouse effect *Fri., 2/1: drop period ends*	Ch 11* pp 70-80; Ch 4
Feb 4th	The atmosphere, CO_2 and the greenhouse effect	Ch 4
Feb 11th	Energy use and tropospheric chemistry *Exam 1: Fri., 2/15 (1/14 to greenhouse effect)*	Ch 5 (to pg. 137)*
Feb 18th	Energy use and tropospheric chemistry Alternative energy (nuclear)	Ch 5 (to pg. 137)* pp 320-27, 335-48
Feb 25th	Alternative energy (photovoltaics and fuel cells) Soil chemistry	Ch 13 pp 46-54, 210-14
Mar 4th	*SPRING BREAK*	
Mar 11th	Soil chemistry and acid rain Water chemistry & buffering *Advising for fall 2019 begins: 3/11 through 3/22*	pp 46-54, 210-14 pp 23-25, 196-210
Mar 18th	Water chemistry & buffering *Exam 2: Wed., 3/20 (tropospheric chem & alt. energy)* *Friday, 3/22: last day to declare P/F or withdraw from courses*	pp 23-25, 196-210
Mar 25th	Water chemistry & buffering Water pollution and treatment	pp 23-25, 196-210 pp 228-36, 241-42, 248-52
Apr 1st	Water pollution and treatment Persistent organic pollutants (POPs)	pp 410-27
Apr 8th	Persistent organic pollutants (POPs) *Exam 3: Fri, 4/11 (soil chem to water poll. & treatment)*	pp 410-27
Apr 15th	Fundamentals of the greenhouse effect	TBA
Apr 22nd	Fundamentals of greenhouse gases and radiative forcing	TBA
Apr 29th	*Final Exam, Monday, Apr. 29th, 10:00-11:00 AM, Jepson 219*	