



## SYLLABUS Environmental Chemistry

The University of Toledo  
Department of Chemistry and Biochemistry  
CHEM 4210/6210/8210

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**Instructor:** Amy Toole

**Email:** amy.toole@utoledo.edu

**Office Hours:** MTuWF 11-12; W 4-5 PM; and by appointment. Talking to students is the best part of my job!

**Office Location:** Remote through Blackboard – [Course Room](#)

**Instructor Phone:** 419-530-1503

**Offered:** Spring 2021

**Course Website:** [Blackboard Learn](#)

**Class Location:** Distance Learning – Exams on campus. Location TBA.

**Class Day/Time:** Distance Learning – Exams on campus. See schedule at end of syllabus.

**Credit Hours:** 3

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### CATALOG/COURSE DESCRIPTION

This course will focus on the chemistry of air, water, and soil with specific emphasis on the effects of human-made chemical products and by-products on the environment. Connections with green chemistry will be highlighted.

### COURSE STATEMENT

During this course we will study the chemistry of the air, water and soil and examine the environmental fate of anthropogenic chemicals released into the environment. We will see how chemical principles can be used to explain and predict reactions, partitioning, and concentrations of anthropogenic chemicals in different environmental compartments. We will examine some of the effects of pollutants on humans, other animals, plants and the nonliving parts of the earth. And, we will consider possible green chemistry, engineering and societal approaches to mitigating deleterious effects of pollution. The course will be beneficial to chemists, chemical and environmental engineers, and environmental scientists. The format of the course will be online.

### STUDENT LEARNING OUTCOMES

#### ***Global Course Learning Outcome:***

At the conclusion of this course, students will be able to apply principles of environmental chemistry to the analysis and critique of current environmental problems and proposed solutions.

#### ***Specific Course Learning Outcomes:***

At the conclusion of the course, students will be able to:

1. Identify and evaluate the relative importance of various reactions, physical processes and transport mechanisms affecting different chemicals in the environment.
2. Apply quantitative problem-solving skills to questions in environmental chemistry.
3. Interpret graphical data.
4. Compare/contrast the composition and temperature profile as well as predominant types of reactions in different regions of the atmosphere.
5. Describe chemical reactions and processes responsible for creating the “ozone hole”.
6. Compare/contrast the conditions and reactions that create photochemical and sulfurous smog.
7. Identify the sources and sinks of common indoor air pollutants.

8. Describe the scientific basis underlying global climate change and the American Chemical Society position and recommendations regarding climate change.
9. Compare/ contrast the chemistry of different environments within the hydrosphere.
10. Calculate equilibrium concentrations of organic pollutants in environmental compartments based on partition coefficients. Assess the advantages and limitations of such calculations.
11. Describe key reactions in carbon, nitrogen and sulfur cycles.
12. Calculate expected aqueous concentrations of different chemical species based on equilibrium coefficients and environmental measurements of pH and Eh. Discuss the advantages and limitations of such calculations.
13. Describe and analyze intersections between environmental chemistry and society including applications of green chemistry.

CHEM 6210 Masters students and CHEM 8210 Doctoral students will also be able to:

14. Apply their background in environmental chemistry and other chemistry courses to the summary and analysis of the textbook information on “Water pollution and water treatment” (Chapter 16).

CHEM 8210 Doctoral students will also be able to:

15. Apply their background in environmental chemistry and other chemistry courses to the summary and analysis of the textbook information on “The chemistry of solid wastes” (Chapter 19).

## **PREREQUISITES AND COREQUISITES**

**Prerequisite:** [CHEM 2420](#) with a minimum grade of D-

## **TEXTS AND ANCILLARY MATERIALS**

**Textbook:** ISBN 019874997X; Gary W. vanLoon & Stephen Duffy; Environmental Chemistry: A Global Perspective; Oxford University Press; 4<sup>th</sup> Edition; 2017.

**Online resources:** links will be provided through Blackboard.

## **TECHNOLOGY REQUIREMENTS, SKILLS, AND PRIVACY POLICIES**

Please view the [technology considerations](#) for this course, including technical skills needed, general technology requirements, and technology privacy policies.

## **ACADEMIC POLICIES**

The University of Toledo maintains academic policies intended to promote fairness and equity among students. These are wide ranging and include policies on adding and dropping a course, dual degree requirements, graduation with honors, academic dishonesty, confidentiality of student records and veteran assistance to name just a few. Please use the following URL to read a comprehensive list of academic policies that may pertain to you in this class and throughout your academic journey: <http://www.utoledo.edu/policies/academic/undergraduate/>. If you have any questions after reading through the policies, let me know.

## **TEACHING METHODOLOGY**

This course emphasizes reading and analysis, making connections between different concepts, applying chemistry, mathematical problem solving and communicating technical information. All assignments and assessments are intended to encourage these higher-level thinking skills.

Reading and Guided Notetaking: Much of your learning will be the result of reading and thinking about what you have read. Readings are assigned on a weekly basis and Guided Notetaking sheets accompany them. The sheets contain some blanks to fill in, but often prompt you to record a chemical reaction, equation, summary or list. Showing Guided Notetaking sheets completed in your own handwriting accounts for a portion of each exam score.

Exams: Three exams will be given during the semester. The exams will ask a sub-set of the questions and problems from the Notetaking sheets you complete while reading through the text. **You may use the Notetaking sheets during the exam, as long as they are completed in your own handwriting.** There is nothing “tricky” about the exams, their purpose is to assess the extent to which you have thought about and applied your background in chemistry to understanding the text.

**Students must take the exams on-campus during the times given on the course schedule or make alternative arrangements for a proctor.** Please visit the [Student Requirements for Off Site Proctored Exams](#) webpage to learn more about this process. For students taking proctored exams, the exams must be taken at the same time or at a time in advance of the on-campus exam. **Proctored Exams:** Three midterm exams will be administered on campus. Specific dates and times are provided in the Course Schedule. Off-campus, proctored testing is an option. Learners pursuing this option will be required to locate an approved proctor and pay for any proctoring expenses. UT Online is available to assist students with off-campus proctoring arrangements. Please visit the [Student Requirements for Off Site Proctored Exams](#) webpage to learn more about this process. Students parking on campus for exams should contact [Parking Services](#) for parking permit options and costs.

Reflections: In brief writing assignments, students will state and support their opinions regarding topics related to environmental chemistry. Please note that the emphasis of this course is chemistry, but by nature the course touches on topics with connections to our lives and society that shouldn't be ignored. Writing reflections gives students an opportunity to process and express their ideas regarding these topics.

Quantitative Problem Solving: Quantitative problems will be assigned throughout the semester. Students will have multiple attempts to solve the problems in advance of the deadline. Solving the problems will require an understanding of material in the text for the course, as well as in pre-requisite courses. You may work with others on these problems. Write out your work neatly: some of the problems may be repeated on the exams and you will want to be able to follow your notes.

Final Presentation: Students will give a live 12-minute oral presentation, built around the cross-section between a scientific or popular press article of their choosing (but will require my approval) and course content.

CHEM 6210 Masters students and CHEM 8210 Doctoral students will prepare guided note-taking pages plus answer questions related to the textbook information on “Water pollution and water treatment” (Chapter 16).

CHEM 8210 Doctoral students will prepare guided note-taking pages plus answer questions related to the textbook information on “The chemistry of solid wastes” (Chapter 19).

**Workweek:** In this online course, weeks begin at 12:01 AM Monday morning and end at 11:59 PM on Sunday night. All assigned work for any week is to be completed by the end of Sunday in that week. The materials for any week will be posted by Monday morning of that week under the appropriate folder. Begin each week by checking the schedule, then view the content for the week under Weekly Content.

**Late Work:** Late assignments and make-up tests will not be permitted unless arrangements are discussed and approved well before the required due date. Time management for this online course will be important. Anticipate spending an average of 9 hours per week.

## COMMUNICATION GUIDELINES

**Course Announcements:** I frequently post Announcements regarding the course to Blackboard (Course News) and forward them to your email. Please check your UToledo email or Course News daily.

**Student to student communication:** A link to Collaborate, a real-time conferencing tool, is on the course menu in Blackboard and available for students to use at any time. Brief introductions and reflections will take place through discussion board threads but you are also welcome to create your own thread to ask questions or pose thoughtful commentary to classmates. Finally there is a link to email on Blackboard that you can use to contact other students in the course.

**Communicating with me:** My email, the link to my virtual office, and the hours I will be there are found at the start of this syllabus. You are always welcome to make an appointment to talk with me outside office hours. I am here to help: it is why I teach.

I prioritize responding to email, discussion board posts, reflections and exams in a timely manner.

## OVERVIEW OF COURSE GRADE ASSIGNMENT

**Midterm Grading:** Midterm grades are assigned by the end of the 8th week of class and are used to assist students with determining their academic standing. Attendance is also recorded during that time to meet state and federal laws regarding financial aid disbursement. Please note, if you are not participating in class it could affect your financial aid (scholarships, grants, loans or Federal Work Study).

Your midterm grade will be calculated as follows:

<b>ASSIGNMENTS/EXERCISES/EXAMS</b>	<b>POSSIBLE POINTS</b>	<b>SLO ALIGNMENT</b>
Exam 1 (including check of Guided Note-taking sheets)	175	1, 3, 4, 5
Reflection	30	6
Quantitative Problem Solving	100	2
<b>TOTAL</b>	<b>300</b>	1-6

Based on the percentage of total possible points earned, corresponding letter grades will be assigned as indicated for final grading (below).

**Final Grading** is based on the percentage of total possible points as detailed below:

<b>ASSIGNMENTS/EXERCISES/EXAMS</b>	<b>POSSIBLE POINTS</b>	<b>SLO ALIGNMENT</b>
Guided Notetaking and Exams (The first two exams are each worth 175 points; the third exam is 100 points)	450	1, 3-9, 11, 13
Reflections (The first reflection is worth 30 points; the remaining two are each 40 points)	110	5-8, 13, 14
Quantitative Problem Solving (Individual problems range from 5-10 points)	290	2, 10, 12
Final Presentation	150	Global Course Objective
<b>TOTAL for CHEM 4210</b>	<b>1000</b>	<i>All</i>
Additional Masters Level Assignment	100	15
<b>TOTAL for CHEM 6210</b>	<b>1100</b>	<i>All</i>
Additional Doctoral Level Assignment	100	16
<b>TOTAL for CHEM 8210</b>	<b>1200</b>	<i>All</i>

Based on the percentage of total points earned, these letter grades will be assigned:

<b>Percentage of Total Points</b>	<b>Letter Grade</b>
90 – 100%	A/A-
80 – 89%	B+/B/B-
70 – 79%	C+/C/C-
60 – 69%	D+/D/D-
< 59%	F

**Drop, Withdrawal and Incomplete Grades:** Dropped courses do not appear on your transcript. The deadline for dropping is February 2<sup>nd</sup>. You may withdraw from the course and receive a grade of W. The deadline for withdrawal is March 26<sup>th</sup>. W's do not affect your GPA but do appear on your transcript. A student, registered for both this course and the laboratory (CHEM1280), who is intending to drop/withdrawal from the lecture course by mid-semester (in first 8 weeks) must also drop the associated lab course.

## UNIVERSITY POLICIES

**Policy Statement on Non-Discrimination on the Basis of Disability (ADA):** The University is an equal opportunity educational institution. Please read [The University's Policy Statement on Nondiscrimination on the Basis of Disability – Americans with Disabilities Act Compliance](#).

**Academic Accommodations:** The University of Toledo embraces the inclusion of students with disabilities. We are committed to ensuring equal opportunity and seamless access for full participation in all courses. For students who have an accommodations memo from Student Disability Services, I invite you to correspond with me as soon as possible so that we can communicate confidentially about

implementing accommodations in this course. For students who have not established affiliation with Student Disability Services and are experiencing disability access barriers or are interested in a referral to healthcare resources for a potential disability or would like information regarding eligibility for academic accommodations, please contact the [Student Disability Services Office](#) by calling 419.530.4981 or sending an email to [StudentDisability@utoledo.edu](mailto:StudentDisability@utoledo.edu).

### **Additional Policy Statements**

Students can find other university policies listed by audience on the University Policy webpage (<http://www.utoledo.edu/policies/audience.html/#students>).

## **ACADEMIC AND SUPPORT SERVICES**

The university provides a variety of academic and support services on campus to help you succeed and reach your fullest potential. Whether you need to ask a question, get help with an assignment, seek advice from a counselor, find a job or join a club, UToledo is there for you! You may contact me, or use the following resources to find the academic support or service you need:

**Student Affairs:** <http://www.utoledo.edu/studentaffairs/>

**Office of Student Advocacy:** <https://www.utoledo.edu/studentaffairs/student-advocacy/> (help with the non-academic challenges)

**Library:** <http://www.utoledo.edu/library/>

**Career Services:** <http://www.utoledo.edu/success/career/>

## **SAFETY AND HEALTH SERVICES FOR UTOLEDO STUDENTS**

Please use the following link to view a comprehensive list [Campus Health and Safety Services](#) available to you as a student.

## **SPECIAL COURSE EXPECTATIONS DURING COVID-19**

This is an unprecedented time for our Rockets community at the University of Toledo. In times of challenge, such as this, we come together to support each other and help keep the more vulnerable members of our community safe during the COVID-19 pandemic. If we all do our part, we will help to minimize the spread of infection and maintain engaging face to face class environments this spring. That is why we are asking all faculty, staff and students to adhere to the special course expectations described below. Please review these policies described below.

**Recitation Attendance:** In order to ensure that we self-quarantine if symptomatic, students, faculty and staff must perform a daily health assessment, based on based on [CDC guidelines](#), before coming to campus each day, which includes taking your temperature. Students who are symptomatic/sick should not come to class and should contact the Main Campus Health Center at 419-530-3451. The University of Toledo has a [missed class policy](#). It is important that you understand the attendance requirements for this course. Please engage with me if you have any questions about these requirements. *Absences due to COVID-19 quarantine or isolation requirements **are** considered excused absences **from face to face classes**.* You should notify me if you are in quarantine or isolation and these absences may not require written notice.

**Face Coverings:** To help keep each other safe, everyone must wear face coverings while on campus,

except while eating, alone in an enclosed space, or outdoors practicing social distancing. Students will not be permitted in class without a face covering. If you have a medical reason that prevents you from wearing a face covering due to a health condition deemed high-risk for COVID-19 by the Centers for Disease Control and Prevention (CDC), you should submit a request for accommodation through the Student Disability Services Office (SDS) by completing this [online application](#). You will need to provide documentation that verifies your health condition or disability and supports the need for accommodations. If you are already affiliated with SDS and would like to request additional accommodations due to the impact of COVID-19, please contact their accessibility specialist to discuss your specific needs.

**Social Distancing:** As further efforts to keep everyone safe, students should practice social distancing inside and outside the classroom, including when you enter and exit. Please maintain at least 6 feet of distance between yourself and others, follow posted signage, and pay attention to the seating arrangements in the classroom. It's important that you do not remove stickers or tape from seats and/or tables, as they are there to provide guidance on the appropriate classroom capacity based on recommended social distancing between individuals. Please be conscious of your personal space and respectful of the space of others in the class.

**Desks and Workspaces:** An important part of keeping our classroom spaces safe involves keeping them sanitized. We ask all students to sanitize their desk and/or workspace before class begins, with the sanitizing spray and paper towels provided in the classroom.

**Special Note:** Although there is a rigorous and evidence-based plan for keeping each other safe during COVID-19, it's important to note that, based on the unpredictability of the virus, things can change at any time. So, please be patient and understanding as we move through the semester. If at any point you have any concerns about class, completing course work/assignments, and/or health concerns related to COVID, let me know.

Please also know that we recognize the COVID-19 situation has placed additional burdens on many of our students. If, at any point in the semester, you experience difficulties meeting your basic needs, managing your different responsibilities, or maintaining your physical or mental health, we have a variety of resources that can help. Review and utilize our [Student Success resources](#) and contact me if you have any questions.

## COURSE SCHEDULE

The anticipated schedule for the class is found below. As instructor, I reserve the right to modify the schedule of topics if I believe it to be in the best interest of the class, however, Exam dates will NOT change. The topics and Chapters are those in the text for this course.

### Environmental Chemistry: CHEM4210/6210/8210 – Anticipated Course Calendar

Week	Dates	Topic	Student Learning Objectives	Assignments Due Sunday at 11:59 each week and Exam dates and times*
1	Jan 19-22	Environmental Chemistry a Global Perspective (Chapter 1)	1, 2, 3, 4, 13	<ul style="list-style-type: none"><li>• Reflection: Syllabus and Introduction</li><li>• Guided note taking</li><li>• Quantitative Problem Solving</li></ul>
2	Jan 25-29	The Earth's Atmosphere (Chapter 2)	1, 2, 3, 4, 5, 13	<ul style="list-style-type: none"><li>• Guided note taking</li><li>• Quantitative Problem Solving</li></ul>
3	Feb 1-5	Stratospheric Chemistry – ozone (Chapter 3)	1, 2, 3, 4, 6, 13	<ul style="list-style-type: none"><li>• Reflection: Smog</li><li>• Guided note taking</li><li>• Quantitative Problem Solving</li></ul>
4	Feb 8-12	Tropospheric Chemistry – smog (Chapter 4)	1, 2, 3, 4, 13	<ul style="list-style-type: none"><li>• Guided note taking</li><li>• Quantitative Problem Solving</li></ul>
5	Feb 15-19 <b>(No Class Feb 16)</b>	Tropospheric Chemistry – precipitation (Chapter 5)	1, 2, 3, 4, 6, 7, 13	<ul style="list-style-type: none"><li>• Guided note taking</li><li>• Quantitative Problem Solving</li></ul>
6	Feb 22-26	The Chemistry of Global Climate (Chapter 8)	1, 2, 3, 4, 8, 13	<b>EXAM 1 – Monday, Feb 22, 5-6 PM (Chapters 1-5)</b> <ul style="list-style-type: none"><li>• Guided note taking</li></ul>
7	Mar 1-5	The Chemistry of Global Climate (Chapter 8)		<ul style="list-style-type: none"><li>• Guided note taking</li><li>• Reflection: Climate Change</li></ul>
8	Mar 8-12 <b>(No Class Mar 10)</b>	The Hydrosphere (Chapter 9) Distribution of Species in Aquatic Systems (Chapter 10)	1, 2, 3, 9, 13	<ul style="list-style-type: none"><li>• Guided note taking</li></ul>
9	Mar 15-19	Distribution of Species in Aquatic Systems (Chapter 10) (Part 2)	1, 2, 3, 4, 9, 10, 13	<ul style="list-style-type: none"><li>• Guided note taking</li><li>• Quantitative Problem Solving</li></ul>
10	Mar 22-26	Gases in Water (Chapter 11) Organic Matter in Water (Chapter 12)	1, 2, 3, 4, 9, 10, 13, 14	<ul style="list-style-type: none"><li>• Guided note taking</li><li>• Quantitative Problem Solving</li></ul>
11	Mar 29- Apr 2 <b>(No Class Mar 29)</b>	Article selection and outline of how to proceed.		<b>EXAM 2 – Tuesday, Mar 30, 5-6 PM (Chapters 8-12)</b>
12	Apr 5-9	Environmental Chemistry of Colloids and Surfaces (Chapter 14)	1, 2, 3, 4, 9, 10, 12, 13	<ul style="list-style-type: none"><li>• Guided note taking</li><li>• Quantitative Problem Solving</li></ul>



Week	Dates	Topic	Student Learning Objectives	Assignments Due Sunday at 11:59 each week and Exam dates and times*
13	Apr 12-16	Microbial Processes (Chapter 15)	1, 2, 3, 4, 9, 10, 13	<ul style="list-style-type: none"> <li>• Guided note taking</li> <li>• Quantitative Problem Solving</li> </ul>
14	Apr 19-23	Toxic Organic Chemicals (Chapter 20)	1, 2, 3, 4, 9, 10, 13	<ul style="list-style-type: none"> <li>• Guided note taking</li> <li>• Quantitative Problem Solving</li> </ul>
15	Apr 26 -30 <b>(No Class Apr 29-30)</b>			<ul style="list-style-type: none"> <li>• Reflection: Toxic Organic Chemicals</li> </ul> <b>EXAM 3 – Wednesday Apr 28, 4-5 PM (Chapters 14, 15, 20)</b>
Finals Week	May 3-7			

\*See Blackboard "Weekly Content" for details regarding Assignments. Refer to the guidelines on obtaining a proctor if you cannot make it to campus at the time of the Exams.