Chemistry
UNIVERSITY OF TORONTO

CHM 310H: Environmental Fate and Toxicity of Organic Contaminants

Winter 2025 Course Syllabus

I TEACHING TEAM

COURSE INSTRUCTOR

Name: Jessica D'eon Email: jessica.deon@utoronto.ca

Class: Tuesdays and Thursdays from 4:00-5:00 PM in WI 1017
Student hours: Tuesdays and Thursdays from 2:30-3:30 PM in LM 119 or by appointment

TUTORIAL TAs

TUT0101: Thursdays from 12:00-1:00 PM in SS 1069
TUT0301: Fridays from 1:00-2:00 PM in UC 152

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II COURSE OVERVIEW

COURSE DESCRIPTION:

Organic chemical contaminants surround us in our everyday lives (medications, personal care products, flame retardants, refrigerants…) and because of this they are present in the environment and in ourselves. In this class we will explore the fate of chemicals in the environment as a whole, as well as in the body, to understand how chemicals can be designed to limit the risks associated with their use and unintended release. Specific topics will include: environmental partitioning; environmentally-relevant transformation processes; the chemistry and effects of redox active species; the toxicity and detoxification of electrophilic species in the body.

STUDENT LEARNING OUTCOMES:

Upon completion of CHM310 you will be able to…

1. …predict where in the environment (air, water, soil, biota…) an organic chemical would be expected to be found as well as how it might undergo degradation using both your chemical knowledge and relevant modelling techniques.
2. …identify common modes of toxicity and predict whether they would be relevant to a given chemical.
3. …be aware of other possible adverse effect outside of a toxicological response and predict whether they would be relevant to a given chemical.
4. …have experience programming in R which includes the uploading a CSV, generating a scatter plot and manipulation of large datasets.

PREREQUISITE COURSES:
This course assumes you have a basic understanding of organic chemistry and so in addition to typical first year prerequisites you need to have completed CHM247 or CHM249.

READINGS:
This class does not have a required text. *Environmental Organic Chemistry* by René P. Schwarzenbach, Philip M. Gschwend and Dieter M. Imoboden is a resource text that was consulted when creating the material and slides. This text is available from the U of T library and could be useful to consult, but is not required. Any additional readings that may be useful will be provided on Quercus.

III COURSE ORGANIZATION

This course is organized into four units:

1. Chemical partitioning in the environment
2. Reactions in the environment
3. Toxicological mechanisms and pathways
4. Other adverse environmental outcomes

Below is an overview of the lecture plan for the semester. This is a plan and may change as the semester progresses. Slides, and readings when relevant, will be posted on Quercus before each lecture.

COURSE SCHEDULE & RELEVANT SESSIONAL DATES:

DATE	UNIT	TOPICS
Tues Jan 7	-	Introduction to environmental chemistry and toxicology
Thurs Jan 9	1	What's the deal with organohalogens?
Tues Jan 14	1	Chemical partitioning
Thurs Jan 16*	1	Linear free energy relationships (LFER)
Tues Jan 21	1	Chemical transport & modelling
Thurs Jan 23*	2	Introduction to atmospheric oxidation
Tues Jan 28	2	Fate of alkoxy radicals and carbonyls **Assignment 1 due**
Thurs Jan 30*	2	Residence time
Tues Feb 4	2	Substitution and elimination reactions in water
Thurs Feb 6*	2	Nucleophile strength and reactions of carbonyls
Tues Feb 11	–	**Midterm**
Thurs Feb 13	2	Reduction in the environment
Tues Feb 18	**Reading Week**	
Thurs Feb 20		
Tues Feb 25	3	How are xenobiotics handled in the body? **Assignment 2 due**
Thurs Feb 27*	3	Receptor-mediated toxicity
Tues Mar 4	3	Electrophilic chemicals
Thurs Mar 6*	3	Reactive oxygen species (ROS)

Tues Mar 11	3	Reactions with biomolecules
Thurs Mar 13	3	Acute and unexpected toxicity **Assignment 3 due**
Tues Mar 18	3	Toxicity models
Thurs Mar 20*	4	Detrimental environmental impacts outside toxicology
Tues Mar 25	4	Ozone depletion
Thurs Mar 27*	4	Global warming potential and the Montreal Protocol
Tues Apr 1	4	Metals **Assignment 4 due**
Thurs Apr 3	–	Review

* Thursdays with an asterisk are those that include a tutorial on either that Thursday (TUT0101) or the next day on Friday (TUT0301)

TUTORIAL OBJECTIVES: The CHM310H tutorials are structured around the CHM310H assignments, three of which include R programming aspects to generate plots or data to be interpreted and discussed in the assignments. Grades are not allocated for the R programming specifically, but you will need to complete the programming tasks to answer the required questions.

IV EVALUATION/GRADING SCHEME

OVERVIEW:

Assignment 1 – due 4 pm on Tuesday Jan 28	5%
Assignment 2 – due 4 pm on Tuesday Feb 25	10%
Assignment 3 – due 4 pm on Tuesday Mar 13	10%
Assignment 4 – due 4 pm on Tuesday Apr 1	10%
Midterm – in class on Tuesday Feb 11	25%
Exam – date and time to be set by FAS	40%

ASSIGNMENTS

Details on the assignments, and tutorial materials that support them, are available on the tutorial page on Quercus.

PRACTICE PROBLEMS

To help you prepare for the midterm and exam, practice problems for each unit of the class will be posted on the class page on Quercus.

V COURSE POLICIES

- Each member of this course is expected to maintain a:

(i) professional and respectful attitude during all course activities, including classes, laboratories, tutorials, and online activity.

(ii) personal calendar/schedule/organizer to ensure that all course activities are completed, and due dates are met.

(iii) collection of notes recorded independently based on concepts covered in course activities (students registered with Accessibility Services requiring a class note-taker will have access to this accommodation)

(iv) familiarity with the University policy on Academic Integrity (bottom of page 5) and the class policy on generative AI technologies (bottom of page 4)

- The University of Toronto is committed to equity, human rights, and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect where all members of our community can express themselves, engage with each other, and respect one another's differences. As a Course Instructor, I will neither condone nor tolerate behaviour that undermines the dignity or self-esteem of any individual in this course and wish to be alerted to any attempt to create an intimidating or hostile environment. It is our collective responsibility to create a space that is inclusive and welcomes discussion. Discrimination, harassment and hate speech will not be tolerated. If you have any questions, comments, or concerns, we encourage you to reach out to the staff in our Equity Offices.

- If you are absent from your studies due to illness or other reasons and unable to complete course work (e.g., a term test or an assignment) then a piece of written documentation is required. The following four items are the recognized forms of documentation:

    1. Absence Declaration via ACORN (please note the circumstances under which an absence declaration can and cannot be submitted)
    2. U of T Verification of Illness or Injury Form
    3. College Registrar's letter
    4. Letter of Academic Accommodation from Accessibility Services

    Students who complete the ACORN Absence Declaration form must additionally contact me to discuss their situation within five business days of the missed piece of work. This is essential action for any consideration to be granted.

    For extended absences and for absences due to non-medical reasons, make sure to contact your College Registrar's Office. They can help you decide between a request for an extension or other types of academic consideration.

    If you suspect or know that you have a disability that is affecting your studies, learn about the services and supports available through Accessibility Services. A disability can be physical disability, sensory disability, a learning disability, mental health disorder or a short-term disability like an injury. If you are not sure whether you have a disability, you can confidentially contact Accessibility Services with your questions.

- Generative AI technologies are evolving quickly and can be useful in both academic and personal settings. **For the R programming tasks in the CHM310H assignments the use of generative AI to troubleshoot errors in computer code is permitted and even encouraged.** The scientific understanding expected in assignments in this class is not conducive to the use of AI technologies as they will often confidently lead you astray, for this reason **generative AI technologies are NOT allowed when crafting**

responses to assignment questions in this course. If you have any question about the use of AI applications for course work, please speak with the instructor.

- If you have content questions, they are best addressed in student hours or using the Piazza discussion board. Questions not related specifically to the course content can be addressed over email (jessica.deon@utoronto.ca) and I will endeavor to answer your email within 24 hrs. on weekdays. Communication with the TAs will primarily take place in tutorial and over the discussion board as they have very limited time allocated to answering emails.

- Late submission of an assignment will result in a 10% per day deduction unless you have discussed the issue with the course instructor before the deadline.

- Students who miss the midterm for a reason beyond their control, and with documentation as outlined above, will have the 25% reweighted to the final exam.

VI TECHNOLOGY REQUIREMENTS

- Specific guidance from the U of T Vice-Provost, Students regarding student technology requirements is available here: https://www.viceprovoststudents.utoronto.ca/student-policies-guidelines/tech-requirements-online-learning/

- Advice for students writing online assessments (quizzes etc.): https://studentlife.utoronto.ca/task/online-exams-and-tests/

- This course requires the use of computers, and technical issues are possible. When working on a piece of academic work, students are responsible for scheduling enough time to allow for reasonable delays due to technical difficulties to be overcome, so such issues will not be acceptable grounds for deadline extension. Particularly, maintaining an up-to-date independent backup copy of your work is strongly recommended to guard against hard-drive failures, corrupted files, lost computers, etc.

VII INSTITUTIONAL POLICIES & SUPPORT

ACADEMIC INTEGRITY

Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. The University of Toronto's Code of Behaviour on Academic Matters (governingcouncil.utoronto.ca/secretariat/policies/code-behaviour-academic-matters-july-1-2019) outlines the behaviours that constitute academic dishonesty

and the processes for addressing academic offences. Potential offences include, but are not limited to:

In assignments:

1. Using someone else's ideas or words without appropriate acknowledgement.
2. Submitting your own work in more than one course without the permission of the instructor.
3. Making up sources or facts.
4. Obtaining or providing unauthorized assistance on any report. **Please note that the use of websites (such as Chegg.com or the course discussion board) to post material/questions or to post/access answers to questions is an academic offence under the University of Toronto's Code of Behaviour on Academic Matters. Alleged instances of this nature are forwarded to the Faculty of Arts & Science Student Academic Integrity office.**

On quizzes and term tests:

1. Using or possessing unauthorized aids.
2. Looking at someone else's answers or collaborating/discussing answers during a quiz or term test.
3. Misrepresenting your identity.

In general academic work:

1. Falsifying institutional documents or grades.
2. Falsifying or altering any documentation required by the University.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, you are expected to seek out additional information on academic integrity from your instructor or from other institutional resources (see www.academicintegrity.utoronto.ca/).

PLAGIARISM DETECTION

Normally, students will be required to submit their course essays to the University's plagiarism detection tool for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the tool's reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of this tool are described on the Centre for Teaching Support & Innovation web site (https://uoft.me/pdt-faq).

COPYRIGHT

If a student wishes to copy or reproduce class presentations, course notes or other similar materials provided by instructors, he or she must obtain the instructor's written consent beforehand. Otherwise, all such reproduction is an infringement of copyright and is absolutely prohibited.

ACCESSIBILITY NEEDS
Students with diverse learning styles and needs are extremely welcome in this course. The University of Toronto is committed to accessibility: if you require accommodations for a disability, or have any other accessibility concerns about the course, please contact Accessibility Services as soon as possible.

ACCOMMODATIONS FOR RELIGIOUS OBSERVANCES
Following the University's policies, reasonable accommodations will be made for students who observe religious holy days that coincide with the due date/time of an assignment, tutorial, class or laboratory session. Students must inform the instructor **before** the session/assignment date to arrange accommodations.

ADDITIONAL SERVICES & SUPPORT
The following are some important links to help you with academic and/or technical service and support:

- General student services and resources at Student Life
- Full library service through University of Toronto Libraries
- Resources on conducting online research through University Libraries Research
- Resources on academic support from the Academic Success Centre
- Learner support at the Writing Centre
- Information for Quercus Support

ACKNOWLEDGEMENT OF TRADITIONAL LANDS
We acknowledge this land on which the University of Toronto operates. For thousands of years, it has been the traditional land of the Huron-Wendat, the Seneca and, most recently, the Mississaugas of the Credit River. Today, this meeting place is still the home to many Indigenous people from across Turtle Island and we are grateful to have the opportunity to work on this land.