

I. Teaching Team



Instructor: Professor Jennifer Murphy Email: jen.murphy@utoronto.ca

Classes: Tues, Thurs 14:00 – 15:00 in LM 161

or if necessary via Zoom: [REDACTED]

Student hours: Monday (12:00 – 13:00 via Zoom), Thursday (15:00 – 16:00)



TAs: Matthew Davis (mg.davis@mail.utoronto.ca)

Olivia Driessen (o.driessen@mail.utoronto.ca)

Please attend the tutorial session for which you are registered on Fridays

Please contact Professor Murphy or a TA if you have any questions or problems. Email is fine for short questions, but conceptual issues are best handled in student hours or by appointment. The teaching team will endeavour to respond to emails within 24 hours on weekdays.

II. Course Overview

Course description This course examines the fundamental chemical processes of the Earth's natural environment, and changes induced by human activity. Topics related to the atmosphere: urban air pollution, stratospheric ozone depletion, acid rain, climate change; the hydrosphere: water resources and pollution, ocean acidification; biogeochemistry, and inorganic metals in the environment. The primary goal of this class is to describe the workings of a complex chemical system using concepts such as chemical kinetics, thermodynamics and oxidation/reduction. The secondary goal is to develop a detailed understanding of a number of important environmental phenomena, such as urban smog and heavy metal pollution.

Student learning outcomes Upon successful completion of this course, students will be able to:

- 1) describe the workings of a complex chemical system using concepts such as chemical kinetics, thermodynamics, and oxidation/reduction
- 2) recognize the chemical aspects of important environmental issues such as urban smog, climate change, and heavy metal pollution
- 3) perform data analysis and visualization of environmental monitoring data accessible on public databases
- 4) access and critically evaluate scientific information in the literature and provide a plain language synopsis

Tutorial objectives The tutorial is a critical element of this course, and weekly attendance is expected. The tutorial will provide instruction on the R software package, opportunities for guided group problem-solving, discussion of news stories related to class material, and will enhance what is covered in the class notes and textbook readings. In addition to the problems tackled during the tutorial, practice problems from the textbook and the solutions to weekly quizzes will also be discussed. A TA is present to guide discussions and answer questions, but active participation from all students is expected.

Pre-requisite courses CHM135H/CHM151Y, (MAT135H/MAT137Y/MAT157Y)

This course assumes you have a basic understanding of kinetics, thermodynamics and electrochemistry from first year chemistry courses, and a basic understanding of calculus from first year math courses.

This course is a pre-requisite for CHM415 – Atmospheric Chemistry.

Required textbook *Environmental Chemistry*, 5th edition, Colin Baird and Michael Cann, W.H. Freeman and Company (new or used at UofT bookstore). A better alternative may be to access a digital copy: [Environmental Chemistry 5th edition | 9781429277044, 9781464129001 | University of Toronto \(vitalsource.com\)](#)

Practice problems at the end of the chapters we cover are a good way to evaluate your understanding.

Course website is on Quercus: <https://q.utoronto.ca> (use your UTORID). You are responsible for checking this site regularly for announcements and content. Skeletal class notes are posted 24 hours prior to each class. Assignments and quizzes will be submitted electronically via Quercus or Jupyter.

III. Course Organization

Grading (maximum of Scheme 1 or Scheme 2 for each student)	Scheme 1	Scheme 2
Assignments (due Sep 21, Oct 3, Oct 17, Oct 31, Nov 21, Dec 5)	30 %	40 %
Press Release (due Nov 17)	10 %	10 %
Pre-tutorial Quizzes	10 %	10 %
Term test (Oct 20, 18:00-20:00 in EX100)	15 %	10 %
Final exam (in-person, cumulative, during finals period)	35 %	30 %

Assignments (due Sep 21, Oct 3, Oct 17, Oct 31, Nov 21, Dec 5 at 5:00 pm ET)

The assignments include a mix of qualitative and quantitative questions following the topics covered in Class. Completion of the assignments should not only further your understanding of the course material but also teach you some basics of scientific computing, data visualization and analysis. You do not need pre-existing knowledge of R or computer programming, and these assignments can be completed from wherever you access the internet currently.

Press Release (due Nov 17 at 5:00 pm ET)

You will write a press release (450-550 words) about a 2022 journal article from *Environmental Science and Technology* (ES&T). The selected article should have an environmental chemistry theme and ideally be related to a topic covered in this course. Specific guidelines will be provided on Quercus and discussed in Class.

Quizzes (due by 10 am ET Friday on most weeks)

Quizzes will be administered via Quercus and consist of a few questions that evaluate your understanding of the class material and related problems from the previous week. Reviewing your course notes, completing the practice problems from the textbook, and actively participating in tutorials are the best way to prepare. Quizzes cannot be submitted late but your lowest quiz grade will be dropped.

Late Penalties

Submitted work (Assignments and Press Release) will be penalized 10 % per day of lateness, to a maximum of 7 days past the due date. If you are experiencing an illness or personal hardship that is interfering with your ability to submit your work by the deadline, you may contact Professor Murphy to discuss a deadline extension.

Course Etiquette

Each member of this course is expected to maintain a:

- (i) professional and respectful attitude during all course activities, including classes, tutorials and online
- (ii) personal calendar/schedule/organizer to ensure that all course activities are completed on time
- (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 (overleaf)

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.

In keeping with this approach, I strongly encourage students to **wear a mask** during class and tutorial, to create a space that is safe and inclusive for others including your fellow students, their family members, and our wider community.

Accessibility Needs

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability or health consideration that may require accommodations, please feel free to approach Professor Murphy and/or Accessibility Services at (416) 978 8060; <http://www.studentlife.utoronto.ca/as>

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.

Absences

Students who miss classes are responsible for making up the missed material. While you are strongly encouraged to attend in person when healthy, classes will be simultaneously broadcast via Zoom. Students who require consideration for missed academic work for any reason (e.g., COVID, other illness or injury, family situation) should report their absence through the online absence declaration. The declaration is available on ACORN under the Profile and Settings menu. Students should also advise Professor Murphy of their absence.

Classes (but not tutorials) will be recorded only to allow for asynchronous viewing for students who are unable to participate synchronously in-person or via Zoom on an infrequent basis. To request a link to the recording for a class you miss due to illness or unavoidable absence, email Professor Murphy with the subject line "CHM210 – Missed Class X", where X is the number of the class (see schedule below).

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 (<https://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 papers and 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 assignment.

On tests and exams:

1. Using or possessing unauthorized aids.
2. Looking at someone else's answers during an exam or test.
3. Misrepresenting your identity.

In 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 <https://www.academicintegrity.utoronto.ca/>).

Use of plagiarism detection software

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>)

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 [Technical Support/Quercus Support](#)

Acknowledgement of Traditional Lands

We wish to 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.

Class Schedule

Class 1 Overview, syllabus, earth system and residence time concepts (pages xix-xxv, 216-219)

Atmospheric Chemistry (Part I of Baird and Cann, page numbers refer to 5th edition)

- Class 2 Stratospheric chemistry, Chapman cycle (pages 1-20)
Class 3 Stratospheric chemistry, catalytic ozone destruction (pages 20-33)
Class 4 Stratospheric chemistry, ozone hole (pages 37-64)
Class 5 Tropospheric chemistry, VOC oxidation (pages 69-76 and 755-771)
Class 6 Tropospheric chemistry, smog and NO_x (page 76-83)
Class 7 Tropospheric chemistry, ozone control strategies (pages 84-101)
Class 8 Air pollution, sulphur emissions and oxidation (pages 109-118, 771-772 and Appendix 1)
Class 9 Air pollution, particulate matter (pages 118-130)
Class 10 Consequences of air pollution: acid rain and human health (pages 135-152)
Class 11 Biogeochemical cycle of nitrogen and redox review (Appendix (AP1-AP2) and pages 193-195)

Energy and Climate Change (Part II of Baird and Cann, page numbers refer to 5th edition)

- Class 12 Greenhouse effect and Earth's energy balance (pages 165 – 177)
Class 13 Major greenhouse gases (pages 177 – 197)
Class 14 Climate impacts of aerosol and SRM geoengineering (pages 197 – 216)
Class 15 Energy use and carbon emissions (pages 223 - 249)
Class 16 Carbon cycle and CRM geoengineering (pages 252 - 267)

Water Chemistry and Water Pollution (Part III of Baird and Cann, page numbers refer to 5th edition)

- Class 17 Natural waters and dissolved oxygen (pages 409-417)
Class 18 Dissolved organic matter, sulfur and acid mine drainage (pages 419-424)
Class 19 Redox chemistry and the pE scale (pages 424-430)
Class 20 Water in equilibrium with carbon dioxide and carbonate (pages 431-442)
Class 21 Water in equilibrium with carbon dioxide and carbonate, continued (pages 431-442)
Class 22 Ions in water (calcium and aluminum) (pages 442-450)
Class 23 Mercury biogeochemistry (pages 519-536)
Class 24 Lead pollution in the environment (pages 537-552)