

Introduction to Green Chemistry (CHMD89H) – Fall 2019

University of Toronto at Scarborough

Welcome to CHMD89! This course will introduce you to the growing field of green chemistry – an interdisciplinary approach to chemistry that strives to develop environmentally benign chemical reactions and processes. The course will begin by introducing the twelve principles of green chemistry followed by the use of green chemistry metrics for quantifying ‘greenness.’ In this context, we will move on to explore major areas of green chemistry research including alternative solvents, catalysis and renewable feedstocks. Examples from industry and from the current literature will be used to reinforce the material and highlight recent advances. The topics covered will be multidisciplinary in nature and will draw on aspects of organic, inorganic and polymer chemistry. Prerequisites for this course include CHMB31 and one of either CHMC41 or CHMC42; CHMC31 is recommended, but not required.

Please take a few minutes to read through this document. It contains important information that will help ensure your success in this course.

Instructor:

Dr. Effie Sauer
EV554
Email: esauer@utsc.utoronto.ca
Office Hours: TBD

Lecture Schedule:

Wednesdays 9 am - 12 pm in IC320

Topics and Due Dates:

Lecture Date	Lecture Topic	Course Work Due*
Sept 4 th	The 12 principles of green chemistry	
Sept 11 th	Green chemistry metrics: Part I	
Sept 18 th	Green chemistry metrics: Part II Life cycle analysis	
Sept 25 th	Introduction to the solvent problem	Problem Set
Oct 2 nd	Green Solvents: Part I	
Oct 9 th	Green Solvents: Part II	Assignment Proposal
<i>Reading Week</i>		
Oct 23 rd	Persistence and Toxicity (Guest Lecture: Prof. D'Eon)	
Oct 30 th	Catalysis: Part I	
Nov 6 th	Catalysis: Part II	Critical Review – Draft
Nov 13 th	Renewable feedstock chemicals	Peer Reviews
Nov 20 th	Commercialization of Green Chemistry Technologies	Critical Review – Final version
Nov 27 nd	--- <i>Student Presentations</i> ---	Presentation

*Unless otherwise instructed, all graded work will be due at the start of lecture.

Text:

There is no required text for this course; readings will be taken from the primary literature and will be posted on Quercus at least one week before each lecture.

Method of Evaluation:

Course grades will be calculated as follows. More detailed descriptions for each item can be found in the sections which follow.

Problem Set	15%
Quizzes (3)	15%
Critical Review	35%
Peer Reviews	10%
Presentation	15%
Course Participation	10%
Total	100%

Problem Set:

There will be a single problem set due in the 4th week of classes. Its purpose is to help solidify your understanding of the foundational knowledge in green chemistry needed to complete the critical review due later in the course. You are welcome to collaborate with your peers while working through the questions; however, each student is expected to hand in their own original work for grading.

Quizzes:

There will be three quizzes during the semester, each worth 5% of your final grade. The questions will be based on lectures and readings from prior weeks; however, the dates of the quizzes will not be announced in advance.

Critical Review:

Over the course of the semester, students will work toward completing a critical review of a recent research article in the field of green chemistry. With guidance from the instructor, students will select a green chemistry themed paper outlining a new and/or improved chemical reaction. Using tools learned in the first part of the course, the published green procedure will be compared and contrasted to an earlier published version of the same reaction. As part of the review, students will also be asked to formulate their own ideas for future research directions in the area.

The grade for this assignment will be made up of two components as follows:

- 10% – Written proposal & in-person discussion with Dr. Sauer
- 25% – Final paper

In addition to the proposal and final paper, students will be expected to submit a draft of their assignment for peer review (see below).

Peer Review:

To help students get some early feedback on their critical reviews, students will review drafts of each other's work using the Peer Review tool in Quercus. Students will be required to submit a draft of their critical review to Quercus two weeks before the final due date. Each draft will then be randomly assigned to two students in the course for anonymous peer review. Using the rubric

provided by the course instructor, students will provide formative feedback on two draft assignments. These reviews will be graded by the instructor for their depth and quality of feedback. Note that students who do not submit a draft of their assignment will not be assigned any peer reviews and will get zero for this portion of the course.

Presentation:

Working in pairs or individually, students will select a Canadian researcher working in Green Chemistry to profile during the last week of classes. Presentations will cover the major research interests of the researcher, as well as a summary of a recently published article.

Course Participation:

A significant portion of your grade will come from your participation in the course. For the most part, this means making a *meaningful* contribution to class discussions and group activities; however, there are other ways of contributing that may also be considered when assigning your grade such as posing thoughtful questions during student presentations, or one-on-one exchanges via email or office hours (provided they demonstrate critical thought about the course material).

Late or Missing Work:

Late work or missing work will result in a grade of zero. Exceptions to this policy will be made only when a legitimate reason can be provided, along with supporting documentation. If the reason for the late or missed work is related to an acute medical issue, a UTSC medical note (http://www.utsc.utoronto.ca/~registrar/resources/pdf_general/UTSCmedicalcertificate.pdf) is required. Note that the completed note must meet the following criteria:

- A doctor must have examined you during the period of illness/injury (not after the fact).
- The missed due date must fall within the indicated start date and anticipated end date.
- The physician must rank your illness as either moderate, serious or severe; illnesses deemed mild or negligible will not be considered valid excuses.

Accessibility:

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the AccessAbility Services Office as soon as possible. I will work with you and AccessAbility Services to ensure you can achieve your learning goals in this course. Enquiries are confidential. The UTSC AccessAbility Services staff (located in AA142) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations (416) 287-7560 or ability@utsc.utoronto.ca.

Academic Integrity:

Academic integrity is one of the cornerstones of the University of Toronto. It is critically important both to maintain our community which honours the values of honesty, trust, respect, fairness and responsibility and to protect you, the students within this community, and the value of the degree towards which you are all working so diligently. According to Section B of the University of Toronto's Code of Behaviour on Academic Matters <http://www.governingcouncil.utoronto.ca/policies/behaveac.htm> which all students are expected to know and respect, it is an offence for students to:

- To use someone else's ideas or words in their own work without acknowledging that those ideas/words are not their own with a citation and/or quotation marks, i.e. to commit plagiarism.

- To include false, misleading or concocted citations in their work.
- To obtain unauthorized assistance on any assignment.
- To provide unauthorized assistance to another student. This includes showing another student completed work.
- To submit their own work for credit in more than one course without the permission of the instructor.
- To falsify or alter any documentation required by the University. This includes, but is not limited to, doctor's notes.
- To use or possess an unauthorized aid in any test or exam.

There are other offences covered under the Code, but these are by far the most common. Please respect these rules and the values which they protect. Offences against academic integrity will be dealt with according to the procedures outlined in the Code of Behaviour on Academic Matters.

Turnitin.com:

Normally, students will be required to submit their course essays to Turnitin.com 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 Turnitin.com reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of the Turnitin.com service are described on the Turnitin.com web site.

If any student wishes to NOT submit their assignments via Turnitin, they should notify the course instructor as soon as possible to discuss alternative means of ensuring the originality of their work. This would likely include submission of students' research notes and/or drafts, as well as a brief in person meeting to discuss the final paper.