

Organic Synthesis (CHMC42H3)
Winter 2022
University of Toronto at Scarborough

Welcome to CHMC42! This course is intended for students who have completed the two-semester introductory courses in organic chemistry (CHMB41/42) and wish to expand their knowledge in modern organic synthesis. CHMC42 offers a systematic training on how to build complex organic molecules, which is the central component of chemical innovation to access diverse organic structures with diverse new functions, such as innovative drug, precise diagnostic agent, energy-harvesting material, green catalyst, functional polymer, eco-friendly pesticide, etc. The laboratory experiments are designed to complement the topics covered in lectures. Organic synthesis is a perfect combination of theory and practice, as you will be experiencing both aspects in CHMC42. This course is going to require some hard work, but you will find your efforts rewarding. Modern organic chemistry is about our daily life and our future, and CHMC42 provides both the theory and the practice to make you prepared to explore this fascinating field.

Students enrolled in CHMC42 must have successfully completed CHMB41 and CHMB42. Please carefully read through this document before we get started. It contains important information which will help ensure you have all the tools you'll need to succeed in this course.

Team:

Instructor:

Prof. Xiao-an Zhang
EV-550
Email: xiaoan.zhang@utoronto.ca
Office Hours: Monday 11:00 am – 13:00 pm

Lab Coordinators:

Prof. Lana Mikhaylichenko
EV-556
Email: lane.mikhaylichenko@utoronto.ca
Office hours: (will be posted on Quercus)

Lecture Schedule:

Monday	10:00 am - 11:00 am
Friday	10:00 am – 12:00 pm

All the lectures will be delivered synchronously on Microsoft Team till January 31, 2022. A [Team link](#) has been made available on Quercus. Further update will be provided as appropriate.

Textbook:

Modern Organic Synthesis: An Introduction, 2nd Edition. by George S. Zweifel, Michael H. Nantz, and Peter Somfai, John Wiley & Sons, Inc.

Suggested References:

- (1) Your CHMB41/B42 textbook;
- (2) *Advanced Organic Chemistry Part B: Reactions and Synthesis*, 5th Ed., by Francis A. Carey and Richard J. Sundberg, Springer.

- (3) The Logic of Chemical Synthesis, by E. J. Corey and Xue-Min Cheng, Wiley
- (4) *March's Advanced Organic Chemistry: Reactions, mechanisms and structure*, 5th or 6th Edition, Michael B. Smith and Jerry March, Wiley.
- (5) *Organic Synthesis: The Disconnection Approach, 2nd Edition*, by Stuart Warren and Paul Wyatt, Wiley

These recommended (not compulsory) readings are available in the UTSC Bookstore, online or the Reserves section of the UTSC Library.

Website:

CHMC42 will be using Quercus to release and archive course-related information including: class announcements, lecture slides, contact information and occasionally some useful outside resources. ***In order for you to receive these information and materials, you must have a valid "utoronto.ca" email account registered with ACORN.***

Email Policy:

Please use a valid "utoronto.ca" account for all CHMC42 correspondence. Emails received from other accounts will not necessarily be answered. When composing your email, please use professional language. Be sure to include the course code in the subject line and sign the email with your first and last name, as well as your student ID. Your email will be answered as soon as possible (likely within 48 hours, unless it is a weekend or holiday). When emailing Prof. Lana Mikhaylichenko, please state which course you are talking about. Prof. Lana Mikhaylichenko is running multiple courses so she needs some context. Questions on the lab material should be directed to Prof. Lana Mikhaylichenko, or your TA.

Term Test:

There will be one midterm test written inside of class time, which will count as 25% of your final grade. The exact date, time, location and material to be tested will be announced as soon as they are available.

Policy on Missed Tests:

Please note that there will be no make-up exams for a missed test. Should you miss a term test due to a legitimate reason, you must submit appropriate documentation within one week of your absence. If the reason is medical, an official UTSC medical form should be downloaded from <http://www.utoronto.ca/registrar/verification-illness-or-injury>

If no acceptable documentation is received, you will receive a grade of zero for that test.

With a validated absence, the value of the missed test will be added to your final exam. Please note that in UTSC Calendar it states: "Students cannot petition to withdraw from a course on the grounds that no work was returned before the last day to withdraw without academic penalty if this is the result of their having been given an extension to complete the work for reasons relating to the individual student and not the rest of the class."

Final Examination:

There will be a ***cumulative*** exam written during the end of semester exam period, which will count as 35% of your final grade. The exact date, time and location will be announced as soon as

they are available. ***Please note that if you miss the Final Exam, you must petition the Registrar's Office to write a make-up exam in the next formal exam period.*** Check the UTSC Calendar for instructions and deadlines.

Labs:

The laboratory component of CHMC42 is compulsory, and, ***in order to pass the course, you must also pass the lab component.***

Please arrive *on time* for your labs and come *prepared*. The experiments are designed such that a *well-prepared* student can complete the experiment in the allotted time. If you haven't read over the procedure ahead of time and made sure that you understand each step, it will likely be difficult for you to finish your work on time. As a suggestion, I recommend that you prepare a point-form version of the lab procedure before coming to each lab.

Lab Schedule: Please read the Introductory part of your lab manual and check the Quercus Lab Schedule part every week before coming to the lab.

Lab Manual:

Lab Manual for this course will be posted on course Quercus page. We will be posting new experiment every week. Please refer to the Lab Schedule part for more details. The introductory part of the Lab Manual has a tentative lab schedule and all the information you need to know about these labs. Please read it before coming to the actual labs.

Lab Coats and Safety Glasses:

Lab coats and safety glasses must be worn at all times in the laboratory. Contact lenses may not be worn in the laboratory. You must bring goggles, a lab coat and a notebook to the labs by yourself. All of these can be purchased from the UTSC Bookstore. You may purchase a lab notebook from the dollar store. The smallest size would be about 6" X 8". The notebook cannot have pages that are easily torn out.

Please make sure your name is in the book as well as on your calculator. *You will not be allowed to work in the laboratory unless you are wearing approved eye protection and a lab coat.*

Absences from the laboratory:

If you need to miss a laboratory period for any valid reason, you must immediately report it to both your TA and to the appropriate Lab Instructor, but no later than 48 hours after the lab. If the reason for your absence is medical then you must provide documentation for this. Normally, this would be in the form of an official UTSC medical note completed by your doctor (http://www.utsc.utoronto.ca/~registrar/resources/pdf_general/UTSCmedicalcertificate.pdf);

Documentation should be provided as soon as possible so that a makeup lab can be scheduled, provided that room can be found in another lab section. ***If no reason for your absence is made, a mark of zero will be given for that lab.***

Lab quiz:

It will be a short 10 min quiz at the beginning of each lab online and later in person once we are back to campus. Please read a Laboratory Schedule section on a Quercus for more information about each lab.

Lab Website:

All your lab grades for this course and any lab announcements will be on the Quercus course page.

Ancillary fees:

The Department of Physical and Environmental Sciences at UTSC provides state-of-the-art education in chemistry. Chemistry being an experimental science makes learning in a laboratory setting critical. In order to provide the latest technology to enhance the student learning experience, UTSC will be charging ancillary fees for all chemistry courses that have a laboratory component. Those fees are used to recover the cost of materials and services used during the lab and to maintain and upgrade the equipment used by students. To view a complete list of those fees, students are encouraged to visit the following link:

[http://www.planningandbudget.utoronto.ca/Assets/Academic+Operations+Digital+Assets/Planning+!\\$26+Budget/2012-13+Category+5+Ancillary+Fees.pdf](http://www.planningandbudget.utoronto.ca/Assets/Academic+Operations+Digital+Assets/Planning+!$26+Budget/2012-13+Category+5+Ancillary+Fees.pdf)

Oral Presentations

The assignment for the oral presentations will be given to you during lab period. The location and time for your presentations will be posted later on a Quercus course page. Please check the Quercus for the detailed explanation about this presentation. Do not worry – historically students do not like the idea about oral presentation at the beginning but really enjoy it at the end.

You will submit your literature assignment through plagiarism checking program imbedded in Quercus. This is a U of T statement about this program:

"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>)."

We will post the detailed explanation of how to use this program later on the course Quercus page.

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 (ability.utsc@utoronto.ca) 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 are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations. More details are available at: <http://www.utsc.utoronto.ca/~ability/>.

Method of Evaluation:

The following grading system will be used to calculate your final grade:

Graded Work	Value
Laboratory*	30%
Term Test (NO MAKE-UP)**	25%
Literature Assignment	5%
Oral Presentation	5%
Final Exam	35%

*You must pass the lab to pass the course.

**If you miss a test with a valid reason as described in the section “Policy on Missed Tests”, its value will be added to that of the final.

Note: To pass the course, you **MUST pass the laboratory and either the term test or the final exam (and receive a final grade of 50+, of course!).**

Online Grades:

Individual grades will be posted on Quercus as they become available. Please check these periodically to make sure that the posted grades match your own records. Any discrepancy should be reported immediately to the instructor or the lab coordinator, as appropriate.

Study Hints:

Organic chemistry is a cumulative subject. As such, an understanding of new material depends on mastery of topics discussed in previous chapters, including that was taught in Organic Chemistry I and II. **Keep up with the material –do not let yourself get behind!!!**

Academic Integrity:

UTSC anticipates that you will pursue your studies with purpose and integrity. The cornerstone of scholarship in all academic disciplines is honesty. UTSC expects that you will approach everything you do here honestly – whether solving a homework problem, or writing an exam. 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/Assets/Governing+Council+Digital+Assets/Policies/PDF/ppjun011995.pdf>)

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 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.

Lecture Topics (tentative):

Below is a list of tentative topics to be covered (in the approximate order that you will see them) along with the corresponding text book sections:

1. Synthetic Design
2. Stereochemical Considerations in Planning Synthesis
3. The Concept of Protecting Functional Groups
4. Functional Group Transformations (I): Oxidation and Reduction
5. Functional Group Transformations (II): The Chemistry of Carbon-Carbon π -Bonds and Related Reactions
6. Formation of Carbon-Carbon Single Bonds
7. Formation of Carbon-Carbon Bonds via Organometallic Reagents
8. Palladium-Catalyzed Coupling Reactions
9. Formation of Carbon-Carbon π -Bonds
10. Synthesis of Carbocyclic Systems
11. The Art of Synthesis (optional)