

CONCORDIA UNIVERSITY
DEPARTMENT OF CHEMISTRY & BIOCHEMISTRY
CHEMISTRY 324/51 - ORGANIC CHEMISTRY III: ORGANIC REACTIONS

This course provides an overview of the mechanistic basis for chemical transformations of organic molecules. The lectures will cover carbon-carbon bond-forming reactions in the context of molecular orbitals, kinetics and thermodynamics, and reaction mechanisms. This is the third course in the sequence following **Organic Chemistry I** and **II** at Concordia, which have previously covered a great variety of reactions involving various functional groups. This course will review and build upon this background, explore new modes of reactivity with carbon-carbon bonds, and consider their application in synthesis.

COURSE FORMAT: In-person lectures and laboratory

INSTRUCTOR: Benjamin Chung Lec. 51: Mondays 18:00 - 20:45
Office: SP-201.06 E-mail: benjamin.chung@concordia.ca

OFFICE HOURS: Mondays (In Office) 16:00 - 17:00
Thursdays (Zoom) 16:30 - 17:30 Zoom: 750 287 2009

AUDIENCE: This course is part of the core component for both Chemistry and Biochemistry programs at Concordia. This means that all students enrolled in the Major, the Specialization and the Honours programs offered by the Department of Chemistry & Biochemistry must take it.

CLASSROOM HEALTH & SAFETY: Before coming onto campus, perform a daily self-evaluation (questions online here: <https://www.concordia.ca/coronavirus/return-to-campus/access.html>). You are permitted to come to campus only if answers to all questions are no. Procedural masks are to be worn at all times in the classroom, and can be obtained at access points throughout campus. Please stay home if you're not feeling well!

SHORT-TERM ABSENCES: There is a new academic policy starting this semester for short-term absences (2 days or less) that replaces the need for a medical note provided that eligibility criteria are met. There are a limited number of these absences that can be taken, and they cannot be during the examination period. I will offer accommodations to the best of my ability for any missed assessments on a case-by-case basis. For more information, including the form that will need to be submitted, please refer to this website: <https://www.concordia.ca/students/absence-form.html>

CONTENT: This course is divided into five topics over 23 lectures of 75 minutes each:

1. Review (5 lectures)
2. Pericyclic Reactions (6 lectures)
3. Organometallic Reagents (3 lectures)
4. Enols, Enolates, and Enamines (6 lectures)
5. Organophosphorus/sulfur-stabilized carbanions (2 lectures)

The review will cover reactions learned to-date in the context of their chemo/regio/stereoselectivities. It will also summarize the concept of reaction mechanisms, acidity, molecular orbital theory, and thermodynamics/kinetics, in order to predict and understand reaction mechanisms and outcomes. There may be new material presented in the review.

The remaining four topics will each present different types of reactions. These expand upon the pre-existing repertoire of functional group-based reactions with new carbon-carbon bond forming reactions. The focus will be on the mechanisms and selectivities observed. Using these reactions, students will be expected to devise the synthesis of medium-sized compounds.

LEARNING OBJECTIVES:

By the end of this course, successful students should be able to:

- Identify and visually represent most functional groups and discuss their properties and reactivities (Intermediate to advanced level)
- Draw mechanisms for the reactions covered in class (Basic to advanced level)
- Predict the chemo/regio/stereoselectivities for all reactions covered in class, in CHEM 221, and in CHEM 222 using steric and electronic effects (Basic to intermediate level)
- Explain the chemo/regio/stereoselectivities for the reactions covered in class using steric and electronic effects (Basic to intermediate level)
- Design a 10 to 20-step synthesis by applying the principles of chemo/regio/stereoselectivities (Basic to intermediate level)
- Use correct laboratory procedures to synthesize, purify, isolate, and characterize simple organic molecules (Intermediate level)
- Write a laboratory report to communicate experimental results in a scientific format. (Intermediate level)

ACCESSIBILITY: I will strive to make the learning experience in this class as accessible and inclusive as possible. Students who know that this course might offer challenges are invited to contact me to discuss their concerns and the possible means and strategies that can be applied to attain the learning objectives. However, if you have accessibility needs that require academic accommodations, please meet with an advisor from the Access Centre for Students with Disabilities (ACSD) as soon as possible. The ACSD advisor will review your documentation and set an accommodation plan with you. As a student registered with the ACSD, you may have access to e-textbooks and course packs. Please enquire with the accessibility advisor.

ACSD Contact information: acsinfo@concordia.ca; 514-848-2424 ext. 3525; SGW Campus, GM-300.

<http://www.concordia.ca/students/accessibility.html>

TEXTBOOKS AND READINGS: I expect that you already have access to a standard organic chemistry textbook, such as Organic Chemistry by Jones, Bruice, Klein, etc. Additional readings, if any, will be posted on Moodle.

ASSESSMENT OVERVIEW:

Surprise quizzes (participation only)	10%
Test 1	15 or 20%
Test 2	15 or 20%
Final Examination	30%
Lab Reports	15%
Lab Examination	10%

The best test will be weighted at 20%. Separate minimum passing marks are required for theory (weighted average of 2 tests, final exam, and quiz participation), for lab (weighted average of lab report and lab exam) and for lab exam. Minimum passing marks for theory and lab exam is 50% (D) and for lab is 60% (C-).

Letter grades will be assigned according to the following criteria:

A+: 90.00-100.00	A: 85.00-89.99	A-: 80.00-84.99
B+: 76.67-79.99	B: 73.33-76.66	B-: 70.00-73.32
C+: 66.67-70.00	C: 63.33-66.66	C-: 60.00-63.32
D+: 55.00-60.00	D: 50.00-55.00	F: see previous paragraph

SURPRISE QUIZZES: 5 or 6 surprise quizzes will be administered throughout the semester, each with 1 - 2 questions related to material covered in the previous lecture. Students will have between 10 - 15 minutes to complete the quiz, and answers will be discussed in the following lecture. They will count just for participation marks only: full credit will only be given if an honest effort is demonstrated.

TESTS & EXAMINATIONS:

1. **Test 1** (October 25, 2021, in class)
 - 1h15 min time limit, designed to be completed in 45 min
 - On material covered up to the end of October 18
2. **Test 2** (November 22, 2021, in class)
 - 1h15 min time limit, designed to be completed in 45 min
 - On material covered between October 25 and November 15
3. **Final Examination** (date and location TBD by Exams Office)
 - 2h time limit, designed to be completed in 1h15 min
 - On all lecture material
4. **Laboratory Exam** (December 6, in class)
 - 30 min time limit, 15 questions
 - On all material covered in the laboratories

LABORATORY INFORMATION:

Laboratory Coordinator: Ms Rita Umbrasas

Office: SP-330.01

Telephone: 514-848-2424 ext. 3354

E-mail: rita.umbrasas@concordia.ca

CHEM 324 Laboratories are located at SP-112.

Laboratories start the week of Monday, September 13

All students must attend the section for which they are registered during these weeks.

Laboratory performance is graded based on the quality of the experimental work, the laboratory reports and a laboratory exam

Do not expect a particular laboratory experiment to be directly related to the material covered in the lectures of the preceding week. **CONSIDER THE LABORATORY WORK AS AN INDEPENDENT AND ADDITIONAL LEARNING EXPERIENCE.**

LABORATORY MANUAL & MATERIALS: The lab manual for the course is: **Operational Organic Chemistry**, a problem-solving approach to the laboratory course” Lehman, John W. 4th Edition, Prentice Hall, 2009. A **coursepack** containing the information can be bought from the University Bookstore. Other items such as lab coats and safety glasses, and a lab note book are mandatory and can be purchased from the bookstore.

LAB CONTENT: The laboratory component of the course is divided into 6 experiments and 1 tutorial spread over 10 weeks.

1. Nucleophilic Substitution of 2,4-Dinitrochlorobenzene (1 week)
2. Kinetic versus Thermodynamic Control in Competing Reactions (2 weeks)
3. Using the Chemical Literature in an Organic Synthesis (Library Workshop) (1 week)
4. Synthesis of 7,7- Dichloronorcarane using a phase transfer catalyst (1 week)
5. Preparation of the Insect Repellent N,N-Diethyl-m-Toluamide (2 weeks)
6. Synthesis of Dimedone and Measurement of its Tautomeric Equilibrium Constant (1.5 weeks)
7. Effect of Reaction Conditions on the Condensation of Furfural with Cyclopentanones (1.5 weeks)

The objective of the first three experiments/tutorial is to get yourself familiarize with the laboratory basic procedures, the library and online searches, and the proper way to write a laboratory report; all of this within an organic chemistry framework. The subsequent experiments (4-7) are touching on more advanced techniques, or topics related to the theory of the course or with important techniques and concepts in organic chemistry. There will be a lab report to write for every experiment. You are invited to consult the laboratory manual for more information on how to write a lab report.

LABORATORY INSTRUCTORS (TEACHING ASSISTANTS): Each laboratory section will have one demonstrator who is a graduate student. You must know his or her name, email and the location of her or his room. You will need to contact your teaching assistant for matters related to your labs.

“CHEM 101”: The Academic Code of Conduct: Ethical Use of Information Sources**MANDATORY QUIZ AND SEMINAR**

As part of your CHEM course, you are **required** to i) attend a Chemistry and Biochemistry Departmental Seminar on the academic conduct code and the appropriate use of information sources and ii) pass the online quiz associated with this seminar (the passing grade for the quiz is 100%). (**Note:** this quiz is graded by the Department of Chemistry and Biochemistry, and you do not have access to it until after you have attended the seminar. Therefore, any other quiz you may have taken on the academic code of conduct does not count toward the CHEM 101 requirement.) The aim of this seminar and quiz is to clarify the academic conduct code in terms of which practices will be considered unacceptable with regards to work submitted for grading in your CHEM course. **You are only exempt from repeating the seminar and the quiz if you have done both in Fall 2016 or more recently,*** otherwise you are required to repeat both this term. This short seminar (1 hour) will be held at the following times (note that you will not be given credit if you join too late and/or leave too early):

Date (Fall 2021)	Time	Mode	Registration link
Sept. 22 (Wednesday)	21:00-22:00	Zoom	https://concordia-ca.zoom.us/meeting/register/tZlucumrqTouHdDujCve8eeyjRsM__6XiQUD
Sept. 23 (Thursday)	21:00-22:00	Zoom	https://concordia-ca.zoom.us/meeting/register/tZEsderyupjluGNdupvk7KE33YXJ6MyAak0An
Sept. 27 (Monday)	19:00-20:00	Zoom	https://concordia-ca.zoom.us/meeting/register/tZlud-urqTMiH91iodapd5geAi05rQtcR_y6

As space for each of the Zoom seminars is limited, please **register early** for your preferred slot (copy the corresponding link above into your browser, and make sure you do not introduce a space: it is “concordia-ca”). Then do not forget to **attend** that seminar slot on the date above!

We will take attendance at the Zoom seminar.

If you do not complete this course requirement, your final grade for the course may be lowered by one full letter grade with an incomplete (INC) notation until such time as this requirement is completed. Please refer to the undergraduate calendar (section 16.3.5) for details on removal of an incomplete notation.

* You are exempt if you can locate your ID in the pdf file located on the Departmental web site (<http://www.concordia.ca/content/dam/artsci/chemistry/docs/Compliance-list.pdf>) and if there is no entry in the “quiz” column for you.

PLAGIARISM AND OTHER FORMS OF ACADEMIC DISHONESTY

The Academic Code of Conduct can be found in section 17.10 of the academic calendar (<http://www.concordia.ca/academics/undergraduate/calendar/current/17-10.html>). Any form of unauthorized collaboration, cheating, copying or plagiarism found in this course will be reported and the appropriate sanctions applied. The mandatory seminar is a clear and fair opportunity to learn what our faculty regards as academic misconduct. Failure to take part in this learning opportunity and thus ignorance of these regulations is no excuse and will not result in a reduced sanction in any case where academic misconduct is observed.

COURSE WITHDRAWALS: Students who withdraw from the course must also check-out from their laboratory section. Only those students registered in the course may attend the laboratory and receive a grade for lab work.