

CHEM 324 ORGANIC CHEMISTRY III - Organic Reaction, Fall 2022

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 introduces their application in synthesis.

Instructor **Dr. Pat Forgione**

Office hours: by e-mail appointment

Email: pat.forgione@concordia.ca

Course Format Lectures: 2.5 h / session, 13 sessions; Wed 18:00 – 20:45, HU-125

Labs: 4 h / week, section specified on your Portal;

Materials required 1) Organic Chemistry, 3rd Edition, D. Klein, Wiley (or eBook)
2) *Organic Chemistry III Lab Manual*: Concordia Dept. of Chem. & Biochem
3) any molecular model kit (e.g., Darling's Molecular Visions, or any other kit)
4) Lab Safety Glasses, lab coat, scoopula, rubber bulb and lab notebook that produces carbon copies (all available from the Concordia bookstore)**Useful resources** 1) M. Jones, Jr., S.A. Fleming, *Organic Chemistry*, Norton Publishing (eBook also available)
2) Jones/Fleming Study Guide & Solutions Manual, Norton Publishing
3) Course website (moodle site on your MyConcordia Portal): for lecture slides, handouts, problem sets
4) *Lab text*: J. W. Lehman, *Operational Organic Chemistry*, 3rd and 4th Ed., Prentice Hall Publishing
5) Interesting Read: Molecules that Changed the World, Nicolaou, K.C. Montagnon, T. Wiley-VCH, 2008 ISBN 978-3-527-30983-2**Molecular models and Chemical Drawing Tools**

Using models helps considerably with many aspects of organic chemistry – many concepts require you to picture, rotate and draw 3D objects. Models **are** permitted in exams. You are strongly advised to buy a model kit. Additionally, online chemical drawing tools can also help in understanding bonding, try this one (although others may also be available): <https://chemdrawdirect.perkinelmer.cloud/js/sample/index.html>

Lectures and readings

Recorded lectures will be provided on moodle that will reinforce and clarify the textbook, with emphasis on important concepts. The best way to use the lectures is to take notes throughout, noting concepts that you did not understand so you can go over them afterwards. Organic chemistry is a logic and problem-solving course. You are provided with the language of organic chemistry, and then asked to solve problems utilizing this new language. As such, it involves critical thinking, applying knowledge to new problems based on the use of the language and an underlying understanding of the material. The best approach to success in organic chemistry is to work at it every day, **cramming does not work for organic chemistry!** Keep up-to-date with the lecture material on a consistent basis. Take detailed notes during the lectures, and then work through them after class. Read the relevant sections of the textbook for clarification, elaboration, and illustrative examples, and use your molecular models to aid with 3-D visualization. Practice applying your knowledge by working through problems. **Then do more problems.** Be careful, to learn, you must work at a problem independently before you look to the solution for answer verification or to get a quick hint. Once you see an answer it becomes obvious but working through a problem without knowing the answer is much more challenging (but more rewarding once you succeed and prepares you best for in-class tests!). Try to find classmates to work through problems with. Being able to teach others key concepts will ensure you truly understand the material.

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>). 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:

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

Quizzes (participation only): 5% (must complete 7 of 10)

Test 1: 10 or 20 %

Test 2: 10 or 20%

Final Examination : 40%

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), 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-).

In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change without notice.

FINAL LETTER GRADES: The letter grades for the course will be based on the following scale:

A+ = 93 – 100%	A = 87 – 92%	A- = 80 – 86%	
B+ = 77 – 79%	B = 73 – 76%	B- = 70 -72%	
C+ = 67 – 69%	C = 63 – 66%	C- = 60 -62%	
D+ = 57 – 59%	D = 53 – 56%	D- = 50 - 52%	F = < 50%

QUIZZES: 12 quizzes will be administered throughout the semester, each with questions related to material covered in the previous lecture. Students will have between 10 - 15 minutes to complete the quiz, and answers will be posted online. They will count just for participation marks only: full credit will only be given if an honest effort is demonstrated. Students need to complete a minimum of 9 quizzes throughout the term to receive full grades. No bonuses will be given for completing more than 9, although students are encouraged to do so.

TESTS & EXAMINATIONS:

1. Test 1 (October 19, 2022, in class)

- 1h15 min time limit, designed to be completed in 45 min

- On material covered up to the end of October 12 class

2. Test 2 (November 23, 2022, in class)

- 1h15 min time limit, designed to be completed in 45 min

- On material covered between start of October 19 class to the end of November 16th class

3. Final Examination (date and location TBD by Exams Office)

- **3h time limit, designed to be completed in 2h15 min**

- **On all lecture material**

4. Laboratory Exam (Final two lab weeks, during your regularly scheduled lab section)

- **One of the lab experiments conducted through the term will be repeated**
- **Grade will be based on the quality and quantity of product obtained, and ability to answer questions related to any of the previously conducted experiments including the one that is being repeated.**

LABORATORY INFORMATION:

Laboratory Coordinator: Ms Rita Umbrasas
Telephone: 514-848-2424 ext. 3354
CHEM 324 Laboratories are located at SP-112.

Laboratories start the week of Monday, September 12

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: see schedule posted on moodle for details

Kinetic versus Thermodynamic Control in Competing Reactions (2 weeks)

Using the Chemical Literature in an Organic Synthesis (Library Workshop) (1 week)

Preparation of the Insect Repellent N,N-Diethyl-m-Toluamide (2 weeks)

Synthesis of Dimedone and Measurement of its Tautomeric Equilibrium Constant (1.5 weeks)

Effect of Reaction Conditions on the Condensation of Furfural with Cyclopentanones (1.5 weeks)

Final Lab Exam will be a repeat of one of the above experiments that will be announced once all the above experiments are completed.

The objective of the first two experiments/tutorial is to get yourself familiarized 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 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 or two graduate student demonstrators. 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.

Office: SP-330.01

E-mail: rita.umbrasas@concordia.ca

“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 2017 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 2022)	Time	Mode	Registration link
Sept. 21 (Wednesday)	21:00- 22:00	Zoom	https://concordia-ca.zoom.us/join/91234567890
Sept. 22 (Thursday)	21:00- 22:00	Zoom	https://concordia-ca.zoom.us/join/09876543210
Sept. 26 (Monday)	19:00- 20:00	Zoom	https://concordia-ca.zoom.us/join/13579246801

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.

PARTIAL LIST OF CONCORDIA UNIVERSITY SERVICES...take advantage, they are there for your benefit!

Concordia's COVID-19 updates

<https://www.concordia.ca/coronavirus.html>

Concordia Counseling and Development offers career services, psychological services, student learning services, etc. -

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

The Concordia Library Citation and Style Guides - <http://library.concordia.ca/help/howto/citations.html>

Advocacy and Support Services - <https://www.concordia.ca/offices/advocacy.html>

Student Transition Centre -

<http://stc.concordia.ca/>

New Student Program -

<http://newstudent.concordia.ca/>

Students with Disabilities - <http://www.concordia.ca/students/accessibility.html>

Student Success Centre -

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

Financial Aid & Awards -

<http://www.concordia.ca/offices/faao.html>

Health Services -

<https://www.concordia.ca/students/health.html>

Sexual Assault Resource Centre -

<https://www.concordia.ca/students/sexual-assault.html>

Student Success Centre -

<http://studentsuccess.concordia.ca/>

Academic Integrity -

<http://provost.concordia.ca/academicintegrity/>