Chemistry 222-02: Organic Chemistry II

Instructor: Dr. Patrick Lutz (he/him/his), jlutz@stlawu.edu, JHS 315
I generally respond to emails within 24 hours during the week.

Class meetings: MWF, 11:40am–12:40pm, Valentine 205

Laboratory meetings: M/T/W, 1:00–4:00pm or M, 5:00–8:00pm
with Prof. Stacy Vassar (svassar@stlawu.edu)

Student hours: Weds., 3:30–5:30pm
Thurs., 9:30–10:30am

Your success in this course is one of my highest priorities. The times listed above are designated as student hours, but if my office door is open (even just a little bit), feel free to knock and I'll try to help out if I have time. You are also welcome to email me to try to schedule another time to meet. If you would prefer to meet virtually, please let me know in advance so that I can make arrangements.

Welcome (Back) to Organic Chemistry! Chemistry is often called "the central science" because it is integral to so many areas of study, and perhaps no subdiscipline of chemistry exemplifies this better than organic chemistry. Without organic molecules, there would be no biology, no neuroscience, and no organic electronic materials, to name a few important examples.

This course is a direct continuation of Chem 221. We will apply the general principles you learned in first-semester organic chemistry to many new classes of reactions, with a major focus on unsaturated C=C (alkenes, aromatic rings) and C=O bonds (the carbonyl group). We will seek to understand how and why these reactions occur (their mechanisms and driving forces), and apply them to multistep synthesis. While we will review some topics as appropriate, a solid grasp of material from Chem 221 is assumed.

Learning goals:

1. Rationalize and predict the reactivity of organic compounds using structural information and knowledge of common mechanistic patterns.
2. Explain how and why organic reactions occur.
3. Devise multistep syntheses of organic molecules.
4. Apply qualitative knowledge of chemical structure and reactivity to new and unfamiliar situations.
5. Execute synthetic procedures in the laboratory and interpret experimental data.

Prerequisites: 2.00 or better in CHEM 221

Required texts and materials:

1. *Organic Chemistry*, 10th edition (2023) and accompanying Student Solutions Manual by McMurry: available for free electronically at openstax.org and for purchase as a hard copy at xanedu.com
2. *Making the Connections: A How-to Guide for Organic Laboratory Techniques*, 4th edition (2023) by Padais and Osbourn
3. Safety goggles
4. Lab notebook with carbonless copy paper

Gradescope:
You will use Gradescope to receive graded quizzes/exams. You can access the Gradescope page for this course via Canvas or at https://www.gradescope.com/courses/702589.

***Caveat emptor*:**
The policies and procedures described throughout this syllabus are subject to modification in response to changing circumstances, or just because we discover that some aspect of the course does not work as well as intended. Of course, I will communicate any important changes as soon as I can.

Evaluation:
Grades will be determined using the components in the table below.

preparedness, participation, and group citizenship	7%
writing assignments	4%
quizzes	10%
quiz corrections	4%
midterm exams	35%
final exam	20%
lab assignments	20%

A partial scale for determining final grades is shown below. Note that you *must* take the final to receive a passing grade. Grades are based on your score alone; there is no "class curve" and you are not competing directly against your fellow students. It is possible that I could lower the grade borders if aspects of the course prove more challenging than anticipated, but I will not *raise* the cut-offs.

4.0	≥ 92%
3.0	≥ 82%
2.0	≥ 72%
1.0	≥ 60%
0.0	< 60%

Course format:
This class will be taught in a "semi-flipped" fashion. Approximately one day per week (usually Wednesday), you will be required to watch lecture videos prior to class. You should take good notes like you would for an in-class lecture. ***This video content is NOT "supplemental"; it will cover core course topics, and your mastery of this material will be tested on quizzes and exams along with content discussed in class.***

Why a semi-flipped class? Look, I know you're all busy people (I am too), but regular guided practice is key success in organic chemistry and many other areas of life. You wouldn't expect to improve your physical fitness by watching someone else do push-ups; you have to do the exercise yourself. In the same way, you cannot expect to learn organic chemistry by watching your instructor at the board; you need to grapple with problems to exercise your mind.

To help facilitate this process, the full class time during flipped days will be dedicated to working through problems in groups, similar to a "peer pods" type meeting. You will be able to get help with course topics from me and your classmates during class. ***However, you CANNOT expect to succeed in organic chemistry just from one hour of problem solving in class each week.***

It is critical for you to dedicate significant time out of class working through textbook problems, and I will provide a list of recommended textbook problems to go with each topic we discuss. You should try to do as many of them as you can, but remember: even if you cannot work every problem, doing some of them is better than doing none of them. There is a free solutions manual for the textbook, but I encourage you to make responsible use of it. Reading the solutions without working the problems yourself is like watching someone else do push-ups again!

Note that there is more detail in the textbook than we have time to cover, even in two semesters. In your preparations, you should focus on material in the course notes, workshops, recommended textbook problems, and/or study guides. Please do not hesitate to ask the instructor for clarification if there are topics in the reading that seem unfamiliar based on our class discussions.

Assessments:

Preparedness, participation, and group citizenship will be evaluated in three main ways. There may occasionally be other small assignments that count towards this part of the grade.

1. Preparedness: For each flipped day, you must answer a brief Pre-Class Concept Check on Canvas after watching the relevant videos; as the name implies, this must be completed prior to class to receive credit.
2. Participation: Attendance and active participation during workshop days is expected. However, I know that absences are sometimes unavoidable, so students who attend and *actively participate* in at least 75% of the workshops will receive full credit for this portion of the grade. While I may collect some student work from these workshops, you will not be graded for correctness on workshop problems.

3. Group citizenship: Play nicely with others. Stay on task and try to ensure that all group members are given a chance to contribute and succeed. Ask for help when you need it. (This is probably good life advice as well.)

Writing assignments. There will be a few brief (≤2 page) writing assignments to help you engage with the broader world of chemistry. Please don't use ChatGPT or other AI tools to write them. I probably can't prevent you from attempting to do so, so I am just going to have to settle for asking nicely. These assignments are not difficult and I hope they will be at least a little bit enjoyable. Material related to these assignments is fair game on quizzes and exams.

Quizzes: In-class quizzes (~20 min) will be given on the days listed in the syllabus. Quizzes will be closed-book and will focus on the material covered since the most recent quiz or exam. Your lowest quiz score will be automatically dropped in calculating your overall course grade.

Quiz corrections: It is in your best interest to identify errors you made on quizzes so that you are less likely to make similar errors on exams. To encourage you to take the time to look over your graded quizzes, you will be required to submit corrections for each quiz (unless you achieve a perfect score on that quiz). Details will be provided in a separate document, but quiz corrections will typically be due in class on the day of the *next* quiz or exam. In calculating your overall course grade, your lowest quiz corrections score will be automatically dropped.

Exams: There will be three closed-book, in-class midterm exams (~60 min) given on dates listed in the course schedule.

The final exam will consist of two parts: (1) A standardized, multiple-choice, cumulative American Chemical Society exam that covers all of CHEM 221 and 222 that will count for 20% of your overall grade. (2) A free-response portion that will focus on material covered in class since Exam 3 but may involve some cumulative questions as well. This portion of the exam will count towards the midterm scores (worth a combined 35% of your grade).

On quizzes and exams, you can expect many questions that look similar, though not necessarily identical, to things you have (hopefully) seen before on workshops, quizzes, and textbook problems. In addition, you will likely encounter some questions that at first glance do not seem familiar and will require you to extend course concepts in new ways – this is necessary to accomplish Learning Goal #4 listed above!

All exams and quizzes must be taken during class time on the day listed on the syllabus unless you have made prior arrangements with the instructor or there is a bona fide emergency. Please inform the instructor ASAP if any conflicts arise.

In calculating your overall grade, your lowest score on the three normal midterms will be automatically replaced with your score on the standardized portion of the final exam if this replacement is favorable.

Lab: The lab is designed to give you hands-on experience with organic chemistry, as well as providing additional practice with the concepts that we cover in lecture. More details about lab assignments will be provided by Prof. Stacy Vassar.

Canvas: The course Canvas page will give you access to this syllabus, lecture notes, workshops/keys, announcements, and other useful resources. Please be sure to check it and your SLU email regularly.

Course materials: Materials from CHEM 222 should not be distributed outside of the educational framework of this course (including and especially online) without prior permission of the instructor.

Student accessibility: It is the policy and practice of St. Lawrence University to create inclusive and accessible learning environments consistent with federal and state law. If you have already established accommodations with the Student Accessibility Services Office, please meet with them to activate your accommodations so we can discuss how they will be implemented in this course.

If you have not yet established services through the Student Accessibility Services Office but have a temporary health condition or permanent disability that requires accommodations (conditions include but not limited to; mental health, attention-related, learning, vision, hearing, physical or health impacts), please contact the Student Accessibility Services Office directly to set up a meeting to discuss establishing with their office. The Student Accessibility Services Office will work with you on the interactive process that establishes reasonable accommodations.

For more specific information about setting up an appointment with Student Accessibility Services please call (315) 229-5537 or email studentaccessibility@stlawu.edu. For further information, see the website at https://www.stlawu.edu/offices/student-accessibility-services.

Student resources: If you experience difficulty during the semester that interferes with your ability to come to class or complete your work, including difficulty securing food or housing, or stress and mental health issues, I urge you to contact the Office of the Dean of Students [in person or by phone at (325) 229-5311] or Health and Counseling Center [in person or by phone at (315) 229-5392]. If the Dean of Students is consulted, they can notify all of your instructors (for all of your classes) at your request. Their services are confidential – so while they may contact your instructors on your behalf to alert them that you are experiencing difficulty, they do not disclose details to your instructors. I am also available to walk you over to the Health and Counseling Center or the Office of the Dean of Students.

Inclusivity: The course instructor is committed to cultivating an inclusive and supportive learning environment that respects and celebrates a rich variety of backgrounds and perspectives. Please speak with the course instructor or the Chemistry Department chair, Prof. Samantha Glazier, if you have an experience in this class that is not consistent with this commitment.

Academic integrity: Per the SLU student handbook, "All students at St. Lawrence University are bound by honor to maintain the highest level of academic integrity. By virtue of membership in the St. Lawrence community, every student accepts the responsibility to know the rules of academic honesty, to abide by them at all times, and to encourage all others to do the same."

The SLU handbook also states that "[i]nstructors have the duty to investigate any instance involving possible academic dishonesty." I am obligated to report any suspected violations of the honor code to the Dean or the Academic Honor Council.

If you ever have questions about what is or is not appropriate academic behavior on any component of this course, please do not hesitate to ask me.

Tutoring: Please visit https://www.stlawu.edu/offices/academic-advising/peer-tutoring for information about tutoring. Requests for tutors may be made using an online form; once completed, a tutor will typically be assigned to you via e-mail within a day or two. Free tutoring is available for most introductory courses and for many popular intermediate-level courses (i.e., most 100-level and selected 200-level classes).

Semester schedule: A tentative schedule of topics is shown beginning on the next page. Note that the exact coverage from day to day may vary a bit, but updates will be provided as necessary.

Day	Date	Topics	Textbook Reading	Assignments
Wed	Jan 17	course intro, review		
Fri	Jan 19	1 addition reactions: alkene hydration, hydrohalogenation	7.7–7.8; 8.3, 8.12–8.13	intro survey due Quiz 0 (Chem 221 review)
Mon	Jan 22	2 alkenes: dihalogenation, halohydrins, hydrogenation	8.2–8.3, 8.6	Writing Assignment 1 due
Wed	Jan 24	3 alkenes: epoxidation, hydroboration, ozonolysis	8.5, 8.7–8.8	flipped day
Fri	Jan 26	4 epoxides	18.4–18.5	Quiz 1
Mon	Jan 29	5 acetylide and Williamson ether; alkyne reduction	9.5, 9.7–9.8; 18.2	
Wed	Jan 31	6 synthesis practice/catch-up day		flipped day
Fri	Feb 2	7 radical bromination of alkenes	6.6 handout on Canvas	Quiz 2
Mon	Feb 5	8 radical halogenation of alkanes	10.2–10.4	flipped day
Wed	Feb 7	**EXAM 1**		
Fri	Feb 9	9 benzene and aromaticity	15.1–15.6	
Mon	Feb 12	10 EAS: halogenation, nitration, sulfonation	16.1–16.2	Writing Assignment 2 due
Wed	Feb 14	11 EAS: Friedel–Crafts	16.3	flipped day
Fri	Feb 16	no class – Winter Break		

Day	Date	Topics	Textbook Reading	Assignments
Mon	Feb 19	12 EAS: directing groups	16.4–16.5, 16.9–16.10	
Wed	Feb 21	13 S_NAr	16.6	flipped day
Fri	Feb 23	14 carbonyl review, hydrates	19.4–19.5	Quiz 3
Mon	Feb 26	15 acetals; protecting gp strategy	19.10	
Wed	Feb 28	16 Wittig; review carbonyl redox rxns	19.2, 19.7, 19.11; 21.6–21.7	Writing Assignment 3 due
Fri	Mar 1	17 synthesis practice/catch-up day		flipped day
Mon	Mar 4	18 carboxylic acids and nitriles	20.5–20.7	Quiz 4
Wed	Mar 6	19 carboxylic acid derivatives: Fischer, acyl substitution, hydrolysis	21.2–21.8	flipped day
Fri	Mar 8	**EXAM 2**		
Mon	Mar 11	20 alpha substitution: tautomers, alpha halogenation	22.1–22.3, 22.5–22.6	
Wed	Mar 13	21 alpha substitution: acetoacetic/malonic ester synthesis, decarboxylation	22.7	flipped day
Fri	Mar 15	22 alpha substitution: alkylation, kinetic vs. thermodynamic enolate	22.7 handout on Canvas	Quiz 5
Mar 18–22		No Class – Spring Break		

Day	Date	Topics	Textbook Reading	Assignments
Mon	Mar 25	23 aldol: self-condensation	23.1–23.4	
Wed	Mar 27	24 aldol: cross-condensation	23.5–23.6 handout on Canvas	flipped day
Fri	Mar 29	25 Claisen condensation	23.7–23.9	Quiz 6
Mon	Apr 1	26 conjugate addition and Michael	19.13; 23.10	Writing Assignment 4 due
Wed	Apr 3	27 Robinson, synthesis	23.12	flipped day
Fri	Apr 5	28 imines, enamines	19.8	Quiz 7
Mon	Apr 8	29 reactions of imines/enamines	24.6 handout on Canvas	
Wed	Apr 10	catch-up day		flipped day
Fri	Apr 12	**EXAM 3**		
Mon	Apr 15	30 dienes: hydrohalogenation, kinetic vs. thermodynamic	14.2–14.3	
Wed	Apr 17	31 Diels–Alder	14.1, 14.4–14.15	
Fri	Apr 19	32 Diels–Alder	30.1, 30.5	flipped day
Mon	Apr 22	33 organometallics: electron counting	handout on Canvas	Quiz 8
Wed	Apr 24	34 organometallics: elementary steps	handout on Canvas	
Fri	Apr 26	No Class – Festival Day		
Mon	Apr 29	35 organometallics: catalytic cycles	10.7 handout on Canvas	flipped day
Wed	May 1	TBD	TBD	Quiz 9
Fri	May 3	TBD	TBD	
Thurs	May 9	**FINAL EXAM** 1:30–4:30pm		