Chemistry 221-01: Organic Chemistry I

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, 9:20–10:20am, Valentine 103

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

Student hours: Monday, 3:30–5:00pm and Wednesday, 3:30–5:00pm.

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 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 polymer materials, to name a few important examples. I am excited to explore the fascinating world of carbon chemistry with you during the coming semester.

Learning goals:

1. Accurately draw and name organic compounds.
2. Describe the physical properties of organic compounds, including stereochemical properties.
3. Relate the structures of simple organic molecules to spectroscopic data.
4. Rationalize and predict the reactivity of organic compounds using structural information and knowledge of common mechanistic patterns.
5. Devise syntheses of simple organic molecules.
6. Apply qualitative knowledge of chemical structure and reactivity to new and unfamiliar situations.
7. Execute synthetic procedures in the laboratory and interpret experimental data.

Prerequisites: 2.00 or better in CHEM 104

Required texts and materials:

1. *Organic Chemistry*, 11th edition (2019) by Carey and Giuliano
2. *Organic Chem Lab Survival Manual*, 10th edition (2016) by Zubrick
3. Lab manual (free download from Canvas)
4. Lab notebook and safety goggles

Recommended materials:

1. Molecular model kit – ***strongly recommended***; you may use the same kit that you have from CHEM 103/104.
2. 3-ring binder for organizing course handouts.
3. Student solutions manual for *Organic Chemistry* by Carey and Giuliano. One copy is on reserve in the library. Brief answers to relevant textbook problems will be made available on Canvas, but the manual contains more complete solutions and discussion.
4. *Organic Chemistry as a Second Language* by Klein – good source of additional practice problems.
5. *Make it Stick: The Science of Successful Learning* by Brown, Roediger, and McDaniel. An excerpt from this book will be distributed as a part of the first Writing Assignment; however, the whole thing is worth reading if you are interested in evidence-based practices on how to learn effectively.

Gradescope:
You will use Gradescope to submit course assignments and to receive graded quizzes/exams. You can access the Gradescope page for this course via Canvas or at https://www.gradescope.com/courses/411869.

Course format:
Course meetings will be held in-person (pandemic-permitting). I will endeavor to use a mixture of lecture and other activities; you may occasionally be asked to watch prerecorded lecture videos in order to free up more class time for active learning opportunities. The material in any such videos should be considered a core part of the course and is fair game for assessment on problem sets, exams, etc. unless otherwise noted.

We're (still) in year 3 of a pandemic; things are weird. Please let me know as soon as possible if you will need to miss class so that we can figure out how to keep you on track (and please don't come to class if you're sick***!). The policies and procedures described throughout this syllabus are subject to change 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.

11 problem sets	10%
4 writing assignments	5%
7 quizzes	10%
3 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%

Note that a minimum grade of 2.00 in CHEM 221 is a prerequisite for enrolling in CHEM 222.

Problem sets will be distributed approximately weekly, and will be graded on the basis of **due academic labor**. Performing "due academic labor" on a problem set is defined as having done **ALL** of the following:

(1) first, making a serious and complete attempt at solving each problem,
(2) then checking your solutions against the posted answer key, and
(3) correcting your own answers using a different color pen.

You will be asked to sign a declaration on each problem set to indicate that all of these items have been completed. Falsely attesting to such a statement would be a violation of the academic integrity guidelines described in the SLU student handbook.

Answer keys to problem sets will be posted on Canvas at the same time that the problem sets are assigned. **You are strongly encouraged to use these answer keys prudently.** The most successful students typically make serious and complete attempts at solving problems on their own before referring to the answer key, and you should seek help from the instructor, classmates, or a tutor if a problem is still unclear even after consulting the key. **As problem sets are graded on the basis of due academic labor, there is no benefit to writing down a perfect answer that you do not fully understand.** Problem sets are your most valuable resource for exam preparation, so you are urged to complete them in a responsible manner. That said, working on problems with classmates is welcome and encouraged so long as all group members actively participate.

Completed problem sets, including the written Due Academic Labor Declaration, should be scanned/photographed and **uploaded to Gradescope as a pdf file by 11:59pm on the due date**. Problem sets may be spot-checked to verify that you are adequately performing all three components listed above. You will receive full credit for all problem sets so long as they are turned in on time, meet the criteria for due academic labor, and have been corrected fully and accurately.

Late problem sets may receive a penalty, and problem sets may not be accepted for credit more than one week after the due date without prior approval. However, your lowest problem set score will be automatically dropped in calculating your overall course grade.

Writing assignments: There will be four writing assignments throughout the term. The assignment guidelines will be provided approximately one week before the deadline, and will ask you to reflect on your course preparation/performance or to engage with articles about contemporary chemistry from the magazine *Chemical & Engineering News*. These assignments are not intended to be overly time-consuming and should be at most 1.5 pages in length.

Writing assignments are due on Gradescope by 11:59pm on the day listed in the syllabus. Late writing assignments may receive a penalty, and writing assignments may not be accepted for credit more than one week after the due date without prior approval. No writing assignments will be dropped in calculating your final grade.

Quizzes: Seven quizzes (~10–15 min) will be given in class 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.

Exams: There will be three closed-book, in-class midterm exams (~60 min) and one cumulative final exam (~120 min) given on the dates listed on the course schedule. The midterms are worth a combined 35% of the final grade, and the final exam is worth 20%. Each midterm will focus primarily on the newest course material, though given the nature of organic chemistry, there will be significant overlap – you cannot just forget the material on previous exams and expect to do well in the course going forward! The final exam will be cumulative (and the final exam for CHEM 222 will cover all of CHEM 221 and 222).

For each of the exams, you may prepare and use one 3.5” x 5” notecard (front and back) of your own hand-written notes containing information you would prefer not to memorize. No exam scores will be dropped in calculating your overall course 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 problem sets, quizzes, and textbook problems. In addition, you will likely encounter some questions that at first glance do not seem familiar will and require you to extend course concepts in new ways – this is necessary to accomplish Learning Goal #6 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.

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.

Study guides and textbook problems: Each week, a study guide will be distributed that contains the key learning goals along with recommended reading from the textbook and a list of relevant textbook problems. These problems will not be collected, but they are a good

resource if you would like extra practice with the course material. Answers to the textbook problems will be posted on Canvas. ***Most students find that working the assigned problem sets alone is not sufficient to achieve the grades they want in Organic Chemistry***; the textbook problems are your next-best resource and should be an integral part of your studying for CHEM 221.

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, problem sets, 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.

Course materials: Materials from CHEM 221 should not be distributed outside of the educational framework of this course (including and especially online) without prior permission of the instructor.

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

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 inormation 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	Suggested Reading	Assignments
Wed	Aug 24	course intro	syllabus; handout from "Make It Stick"	Intro Survey due Thurs.
Fri	Aug 26	1 atomic structure	1.1–1.3	
Mon	Aug 29	2 Lewis structures, electronegativity, formal charge	1.4–1.5	*lab starts this week!* Writing Assignment 1 due
Wed	Aug 31	3 bonding and hybridization	1.9–1.10; 2.2–2.4, 2.6–2.9	PS1 due
Fri	Sep 2	4 resonance; functional groups	1.7–1.8; 2.1, 2.10; 5.1	
Mon	Sep 5	5 constitutional isomers; nomenclature	1.6; 2.12–2.19; 5.2	PS2 due
Wed	Sep 7	6 acyclic conformational analysis	3.1–3.3	Quiz 1
Fri	Sep 9	7 cyclic conformational analysis	3.4–3.12	
Mon	Sep 12	8 stereochemistry: enantiomers	4.1–4.5, 4.8; 7.3	PS3 due
Wed	Sep 14	9 stereochemistry: *R*/*S* configuration, diastereomers	4.6, 4.10, 4.12; 7.4	Quiz 2
Fri	Sep 16	10 stereochemistry: *meso* compounds	4.11, 4.14	
Mon	Sep 19	11 intermolecular forces	2.22; 5.6; 6.9 ("classification of solvents" only)	PS4 due
Wed	Sep 21	catch-up day		
Fri	Sep 23	**EXAM 1**		

Day	Date	Topics	Suggested Reading	Assignments
Mon	Sep 26	12 intro to spectroscopy, IR	14.1–14.2, 14.21–14.22	
Wed	Sep 28	13 ^{1}H NMR spectroscopy	14.3, 14.6	Writing Assignment 2 Due
Fri	Sep 30	14 ^{1}H NMR spectroscopy	14.4–14.5, 14.7–14.10, 14.12	
Mon	Oct 3	15 Brønsted acids/bases	1.11–1.14	PS5 due
Wed	Oct 5	16 Lewis acids/bases; intro to nucleophilic substitution	1.15; 6.1	Quiz 3
Fri	Oct 7	17 S_N2 reaction	5.4, 5.7; 6.2–6.5, 6.10	
Mon	Oct 10	18 alkene structure & nomenclature; E2 reaction	7.1–7.2, 7.8, 7.15–7.16, 7.20	PS6 due
Wed	Oct 12	19 S_N2 vs. E2	7.19	Quiz 4
Fri	Oct 14	No Class – Fall Break		
Mon	Oct 17	20 E1 and S_N1 reactions	5.9; 6.6–6.7; 7.18	Writing Assignment 3 Due
Wed	Oct 19	21 S_N and E reactions of alcohols	5.8, 5.10–5.11, 5.13, 5.15; 7.9–7.12	
Fri	Oct 21	22 rearrangements in S_N/E reactions	5.12; 6.8; 7.13	PS7 due
Mon	Oct 24	23 wrapping up S_N/E reactions	6.9, 6.11	Quiz 5
Wed	Oct 26	catch-up day		
Fri	Oct 28	**EXAM 2**		

Day	Date	Topics	Suggested Reading	Assignments
Mon	Oct 31	24 intro to addition reactions: alkene hydration, hydrohalogenation	8.4–8.7	
Wed	Nov 2	25 alkenes: dihalogenation, halohydrins, hydrogenation	8.1–8.3, 8.10	Writing Assignment 4 due
Fri	Nov 4	26 alkenes: epoxidation, hydroboration, synthesis	8.8–8.9, 8.11, 8.14	
Mon	Nov 7	27 alkynes: hydrohalogenation, dihalogenation, hydration, hydroboration, tautomerization	9.2, 9.4, 9.10–9.12	PS8 due
Wed	Nov 9	28 synthesis of alkynes: elimination, alkylation	9.5–9.7	Quiz 6
Fri	Nov 11	29 alkynes: ozonolysis, hydrogenation, dissolving metal reduction	8.12; 9.9, 9.13–9.14; 10.6	
Mon	Nov 14	30 radical addition of HBr	10.1, 10.5	
Wed	Nov 16	31 alkane halogenation, radical reactions in synthesis	10.2–10.4, 10.7; 11.3	PS9 due
Fri	Nov 18	32 radical polymerization	10.8	Quiz 7
Nov 21–25		No Class – Thanksgiving Break		
Mon	Nov 28	33 radical cyclizations	N/A	
Wed	Nov 30	catch-up day		PS10 due
Fri	Dec 2	**EXAM 3**		

Day	Date	Topics	Suggested Reading	Assignments
Mon	Dec 5	34 conjugated dienes; diene hydrohalogenation	11.5–11.7, 11.10	
Wed	Dec 7	35 Diels–Alder	11.12–11.14	PS11 due on Thurs.
TBA		Optional Review Session – Details TBA		
Thurs	Dec 15	**Final Exam** 8:30–11:30am		