Chemistry 205: Principles of Organic Chemistry

Instructor: Dr. Patrick Lutz (he/him/his), (440) 775-8892, patrick.lutz@oberlin.edu
I generally respond to emails within 24 hours during the week.

Virtual class meetings: Tuesdays and Thursdays, 11:10am–12:25pm on Zoom

- Zoom meeting link: https://oberlin.zoom.us/j/92664988716?pwd=R3NCcDdvZWpqRnNGcDdveUh2M3dFUT09
- Password: carbon12

Laboratory meetings (in person): Tuesdays–Thursdays, 1:30–4:30pm, Science Center N389

Individual/small group virtual student hours:
Exact times may change in response to student demand, but for now:

- Mondays from 3:30–5:30pm
- Tuesdays from 4:30–5:30pm
- Wednesdays from 9:30–10:30am

Sign up for an appointment using Google calendar at https://rb.gy/mwyl5c; you will receive an email confirming the meeting with a Zoom link. If you would like to meet in groups, please have one person sign up and share the link with the other group members.

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 biochemistry, no neuroscience, no polymer chemistry, and no organic electronics, to name a few important examples. I am excited to explore the fascinating world of carbon chemistry with you during this unusual semester.

Learning goals: This course is a one-semester introduction to organic chemistry, the study of carbon-containing compounds. By the end of this course, students should be able to:

1. Accurately draw and name organic compounds.
2. Describe the physical properties of organic compounds, including stereochemical properties.
3. Determine molecular structure using 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.

This course provides a foundation for more advanced organic (CHEM 325) and bioorganic (CHEM 254) courses.

Prerequisites: C– or better in CHEM 102 or CHEM 103

Required texts and materials:

1. *Organic Chemistry*, 6th edition (2015) by Marc Loudon and Jim Parise. The 5th edition is also acceptable, but note that reading assignments and suggested problems will be drawn from the 6th edition and may not exactly match with other versions. Note that this is the same text for CHEM 254, so you may be able to re-use it in a future semester.
2. *Chemistry 205 Laboratory Manual* (available in lab, $4)
3. Laboratory safety goggles (available in lab, $15)
4. Laboratory notebook (available in lab, $5)

Additional recommended resources:

1. Molecular modeling kit (available in lab, $17)
2. *Organic Laboratory Techniques*, 3rd edition (2001) by Fessenden, Fessenden, and Feist (there are a few copies for reference in the organic lab)

Note that the *Lab Manual* is required and will be provided on the first day of in-person lab. You will also need to purchase safety goggles and a lab notebook if you do not still have these items from previous semesters. Molecular modeling kits will also be available in lab on this day. We will record which items you purchase and your student account will be charged as appropriate, so you need not bring cash with you.

Course format:
Due to public health considerations, the lecture portion of this course will be conducted 100% virtually. The lecture content will be delivered largely through prerecorded videos, with synchronous class sessions reserved for student-led discussions of problem sets and open question and answer sessions.

The laboratory portion of this course is slated to occur in person, with an appropriate number of students in each section to enable physical distancing. While we hope and have planned for a full term of experiments, we recognize the possibility that health conditions may interrupt these plans at some point during the semester.

You should monitor your email and check the course Blackboard site daily; as there will not be in-person course meetings besides labs, these will be the primary places where important course information will be communicated.

This is an unusual academic year. We are all figuring out things as we go, myself included. I've tried to design a course that I think will make the best of the situation at hand, but I reserve the right to make modifications to the format and procedures described in this syllabus in response to changing conditions, or just because we discover that some aspect of the course doesn't work out as well as I thought it will. Of course, I will let you know of any such changes as we move through the semester.

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

9 best quizzes	9%
3 midterm exams	36%
final exam	20%
participation	10%
lab notebook and lab reports	25%

The scale for determining final grades is shown below. Note that grades are based on your score alone; there is no "class curve" and you are not competing directly against your fellow students for a grade. It is possible that I could lower the grade borders if quizzes/exams prove more challenging than anticipated, but I will not *raise* the cut-offs.

A–	≥ 90%
B–	≥ 80%
C–	≥ 70%
D–	≥ 50%

Participation will be assessed in two main ways:

1. You will be asked to complete a short response to each week's lecture videos by answering questions such as: "What do you think were the most important topics from this week's material?" or "What topics did you find the most confusing?" Your response will be due on Blackboard each Sunday at 11:59pm. The aggregated responses will help me anticipate likely topics of discussion for the coming week's classes.
2. Groups of ~3 students will be assigned to present their solution to a question from the weekly problem set during Tuesday class meetings. Each student/group should expect to present approximately once every four weeks.

There may occasionally be other tasks, such as completing surveys, that will be counted for participation credit. These opportunities will be announced via email or on Blackboard.

Problem sets will generally be posted on Wednesdays and discussed during class time on the following Tuesday. While these problems will not be collected for a grade, you are ***highly encouraged*** to complete the problem set prior to the in-class discussion in order to gain the maximum educational benefit from both the problem set itself and the class session. Working together (virtually) on the problem sets is also ***highly encouraged***.

Quizzes and exams:

There will be three midterm exams and one final exam for this course. The midterm exams are worth a combined 36% of the final grade, and the final exam is worth 20%. Quizzes will

be given most weeks that do not have an exam scheduled and are worth a combined 9% of the total grade (the lowest quiz score will be dropped).

Quizzes and exams are planned to be open-book assessments and must be completed ***individually***. While the focus of each quiz/exam will be on the most recently covered material, these assessments are cumulative and may require knowledge of earlier course topics.

Quizzes/exams will be released on Blackboard at a pre-announced time. The deadline will also be listed on the course Blackboard site, as will the total time allotted for you to take the quiz/exam. For example, a quiz may be released on Thursday at 4:30pm and due on Friday at 5:00pm with a time limit of 30 minutes (though it is not expected that a student who has kept up with the course material will require the full amount of time). This means that you need to set aside a block of time of 30 minutes within the given time window to complete the quiz in a single sitting (not two blocks of 15 minutes, for example). You will be asked to record your start/end times on the front page, and you should upload the quiz/exam promptly after completing it.

Quizzes/exams should be completed by hand (not using ChemDraw or similar software). If possible, it is preferred that you print the quiz/exam, but if not, it is acceptable to complete it on a separate sheet of paper *so long as your work is organized and easy to follow*.

You should submit your completed assessment on **Gradescope** (https://www.gradescope.com/courses/171574/, entry code: **MXB73G**) by the deadline as a single pdf file. There are a number of free apps, such as Evernote Scannable and Genius Scan, that allow you to generate a pdf directly from a smartphone. Please be sure to double check that all of the pages are included in the pdf file, legible, properly oriented, and in the correct order before you submit the file. Once you upload the file, you will need to select the page(s) that includes your answer for each question. A document will be posted to Blackboard with details about how to scan and submit your work.

For the purposes of this course, "open-book" means that you may use the course textbook, your personal notes, material posted on the CHEM 205 Blackboard site, molecular models, and a calculator. You may NOT use other sources, including but not limited to external (non-Blackboard) websites and any human being who is not you. **If you have any questions about whether something is an acceptable source to use during an open-book assessment, please ask Dr. Lutz!!**

I am aware of resources such as Chegg, Course Hero, and r/chemhelp. If I discover that *any* CHEM 205 material has made its way onto these or similar sites, I will need to implement more strict protocols for course assessments, which will make for a less enjoyable experience for all of us. Don't be the person who ruins it for your classmates.

Exams and quizzes must be taken during the scheduled window unless prior arrangement has been made with the instructor. If an assessment needs to be moved due to a medical issue or other emergency, you must contact Dr. Lutz at least 24 hours prior to the beginning

of the scheduled window. Quizzes/exams missed without prior arrangements due to emergencies may require a note from a dean and/or a doctor.

Note that I will not answer course content–related questions sent during any quiz/exam window until after said window has passed (even if you have already turned in your assignment).

Lab report forms for each experiment will be uploaded to Blackboard. Lab reports are due electronically by the beginning of the lab section one week after completion of the experiment. You must use ChemBioDraw to draw chemical structures when writing your lab reports. The lowest lab report grade (excluding the Spectroscopic Unknown lab report) will be omitted when determining your final course grade.

Lab notebook: A critical aspect of a scientist's work is maintaining a detailed log of operations performed and observations in the lab. To encourage good lab notebook recording skills, you will be asked to submit scanned copies of your lab notebook pages along with the lab report form for some experiments. Further details about the required content for the lab notebook are available in the *Chemistry 205 Laboratory Manual.*

Oberlin Workshop Learning Sessions (OWLS): We have two designated OWLS for CHEM 205 (Sam Weaver and Aziz Mohammed) who will be running weekly virtual help sessions via Zoom on Wednesday evenings.

Academic Advising Resource Center Private Tutoring: A limited number of private tutors are available for students who request them.

Accommodations: If you have a disability that may have some impact on your work in this class and for which you may require accommodations, please see the instructor and the Office of Disability Resources [disability.resources@oberlin.edu, (440) 775-5588] so that appropriate accommodations can be arranged. A disability may be disclosed at any point during the semester but should be brought up with at least 24 hours' notice before a deadline in order to set up appropriate accommodations.

Inclusivity: The course instructor, TAs, and OWLS leaders are 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, Jason Belitsky, if you have an experience in this class that is not consistent with this commitment.

Honor code: You must write and sign the Honor Pledge ("I have adhered to the Honor Code in this assignment") in order to receive credit for lab reports, quizzes, and exams in CHEM 205. You are encouraged to (virtually) discuss lab experiments with your classmates, but all parts of the lab reports (including data, calculations, and answers to any questions) must represent your own work.

Weekly schedule: To meet the challenges of a virtual lecture course, we will attempt to maintain a regular weekly rhythm. Of course, circumstances may require us to occasionally deviate from this schedule, but a general outline of what you should expect each week is shown below:

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday
• weekly response due on Blackboard	• lecture videos posted • weekly learning goals posted	• discuss last week's PS in class • PS key posted (after class)	• lecture videos posted • PS posted	• group Q&A in class (not on exam days) • quiz/exam released	• quiz/exam due on Gradescope

During most ***Tuesday class sessions***, several groups of ~3 students will each present the solution to a problem from the problem set (PS) posted the previous week; presentation assignments will be sent out the same day each PS is posted. Presenters may use any number of formats to present their solutions (draw out the answer live using a tablet or smartphone as a document camera, generate structures in ChemBioDraw, photograph a handwritten solution, etc.), and groups should come prepared to answer questions from other participants about their problem. Groups are welcome to schedule a meeting with me before the Tuesday class session to discuss any points of confusion ahead of time.

Thursday class sessions are generally reserved for group Q&A sessions. I will not plan new content for these sessions but will instead use the time to answer student questions. These sessions will not be held on exam days to ensure that students can use class time to complete the exam if necessary.

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	Lecture Topics (prerecorded videos)	Suggested Reading in Loudon	In Class (11:10am–12:25pm)	Quiz (due Friday @ 5pm)
Tues	Sep 1	**Lecture 1** Lewis structures	1.1–1.3	course intro	
Thurs	Sep 3	**Lecture 2** formal charge, bonding, and hybridization	1.5–1.9; 4.1a–b; 14.1	group Q&A	**Quiz 0** (syllabus & course logistics)
Tues	Sep 8	**Lecture 3** resonance; functional groups; constitutional isomers; nomenclature	1.4; 3.3; 15.6; 2.1–2.2, 2.4, 2.8	**discuss PS 1** (covers through L2)	
Thurs	Sep 10	**Lecture 4** cycloalkanes; conformational analysis	2.3, 2.5; 7.1–7.5 (skip 7.4b)	group Q&A	**Quiz 1** (covers through L2)
Tues	Sep 15	**Lecture 5** stereochemistry	4.1c, 4.2b; 6.1–6.3, 6.4b, 6.6	**discuss PS2** (covers through L4)	
Thurs	Sep 17	**Lecture 6** more stereochemistry; intermolecular forces	6.7, 6.9; 2.6; 8.4–8.8	group Q&A	**Quiz 2** (covers through L4)
Tues	Sep 22	**Lecture 7** acid/base chemistry; thermodynamics	3.1–3.2, 3.4–3.6	**discuss PS3** (covers through L6)	
Thurs	Sep 24			**Exam 1** (covers through L6) due Friday at 5pm	

Day	Date	Lecture Topics (prerecorded videos)	Suggested Reading in Loudon	In Class (11:10am–12:25pm)	Quiz (due Friday @ 5pm)
Tues	Sep 29	**Lecture 8** mass spectrometry; degree of unsaturation; UV-vis spectroscopy	2.2; 4.3; 12.1, 12.6; 15.1–15.2c	**discuss PS4** (covers through L7)	
Thurs	Oct 1	**Lecture 9** IR spectroscopy; intro to NMR spectroscopy	12.2–12.5; 13.1–13.2	group Q&A	**Quiz 3** (covers through L7)
Tues	Oct 6	**Lecture 10** ^{1}H NMR spectroscopy	13.3–13.4, 13.6–13.7; 16.3; 19.3; 20.3; 21.4; 23.4	**discuss PS5** (covers through L9)	
Thurs	Oct 8	**Lecture 11** ^{13}C NMR spectroscopy; solving spectral problems	13.9–13.10	group Q&A	**Quiz 4** (covers through L9)
Tues	Oct 13	**Lecture 12** kinetics and reaction mechanisms; S_N2 substitution	2.4e; 3.2b; 9.1–9.4	**discuss PS6** (covers through L11)	
Thurs	Oct 15			**Exam 2** (covers through L11) due Friday at 5pm	
Tues	Oct 20	**Lecture 13** alkene structure and nomenclature; E2 elimination	4.1–4.2, 4.5; 9.5	**discuss PS7** (covers through L12)	
Thurs	Oct 22	**Lecture 14** more nucleophilic substitution and elimination: S_N1/E1	4.7c; 9.6–9.7	group Q&A	**Quiz 5** (covers through L12)

Day	Date	Lecture Topics (prerecorded videos)	Suggested Reading in Loudon	In Class (11:10am–12:25pm)	Quiz (due Friday @ 5pm)
Tues	Oct 27	**Lecture 15** electrophilic additions to alkenes	4.6–4.9; 5.1–5.3; 7.8	**discuss PS8** (covers through L14)	
Thurs	Oct 29	**Lecture 16** benzene and aromaticity; intro to electrophilic aromatic substitution	15.7; 16.1, 16.6	group Q&A	**Quiz 6** (covers through L14)
Tues	Nov 3	**Lecture 17** electrophilic aromatic substitution	16.4	**discuss PS9** (covers through L16)	
Thurs	Nov 5	**Lecture 18** substituent effects in electrophilic aromatic substitution	16.5	group Q&A	**Quiz 7** (covers through L16)
Tues	Nov 10	**Lecture 19** intro to the carbonyl group; irreversible nucleophilic addition to C=O	9.8; 19.8a, 19.9; 20.10; 21.9a–b, 21.9e, 21.10a	**discuss PS10** (covers through L18)	
Thurs	Nov 12			**Exam 3** (covers through L18) due Friday at 5pm	
Tues	Nov 17	**Lecture 20** reversible additions to C=O: acetals, hydrates, imines, and enamines	19.7; 19.10–19.11	**discuss PS11** (covers through L19)	
Thurs	Nov 20	**Lecture 21** oxidation reactions	10.6–10.7; 19.14	group Q&A	**Quiz 8** (covers through L19)

Day	Date	Lecture Topics (prerecorded videos)	Suggested Reading in Loudon	In Class (11:10am–12:25pm)	Quiz (due Friday @ 5pm)
Tues	Nov 24	**Lecture 22** reactions of carboxylic acids	20.6–20.9	group Q&A	
Thurs	Nov 26	THANKSGIVING		NO CLASS	
Tues	Dec 1	**Lecture 23** nucleophilic acyl substitution	21.5–21.8	**discuss PS12** (covers through L21)	
Thurs	Dec 3	**Lecture 24** radicals	5.6, 9.10	**discuss PS13** (covers through L23)	**Quiz 9** (covers through L23)
Sun	Dec 13	**Final Exam Due** details TBA			