

**Selected Topics in Advanced Chemistry:
Organic Reactions and Synthesis**

CHEM 5385

Spring 2022

Instructor: Dr. Meagan Hinze (she/her)
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Office Hours: MWF 3-4 pm or by appointment

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Lecture Location and Time: MWF 9:00-9:50 am CFS:101

Please consider wearing a mask in indoor spaces. As both a courtesy and precaution, Dr. Hinze (who is fully vaccinated and boosted) will be wearing a mask at all times.

Blackboard: This online course tool will be used for posting homework, reading assignments, answer keys, and additional resources.

Recommended Textbook Materials:

Strategic Applications of Named Reactions in Organic Synthesis by László Kürti and Barbara Czakó

The Art of Writing Reasonable Organic Reaction Mechanisms by Robert B. Grossman (SHSU library has a digital copy and a physical copy of the 2nd edition).

Course Description:

This course is intended to expand our horizons past undergraduate level organic chemistry for how molecules can be modified or combined. We will investigate a wide scope of methodologies as well as their applications in [total] synthesis. Even for those who do not consider themselves organic chemists or organic curious, the goal is to gain a better appreciation for organic reactions and their use in academia and industry.

Attendance Policies:

- Class attendance is expected and highly encouraged.
- If you are absent, you are responsible for acquiring the missed material. (My written out lecture notes are posted on Blackboard by the end of each lecture day.)
- If you are ill the day an assignment is due, please inform me at your earliest convenience so that we may discuss an alternative.
- Accommodations for exams due to illness are possible but need to be requested prior to class and not after the fact.

Teaching Methods:

This class is a discussion about chemistry. Our learning should not be passive, and demonstration of content comprehension can be strengthened through explaining to others. Although there is no required textbook for the course, regular handouts and readings will be distributed as necessary to further our understanding. If their contents are essential for a specific lecture, then the reading will be distributed the prior lecture period.

In our growth as scientists, strengthening our skills for presenting information and ideas is essential. Here, we will have opportunities to do so in the context of organic reactions and synthesis. It can feel tough at first (especially if you didn't do the chemistry with your own hands), but honing presentation skills is an important and ongoing process.

A Few Learning Objectives:

- To differentiate between types of reactivity and fundamental differences in reaction mechanisms and outcomes.
- To recognize the different functional handles on organic molecules, the relationship of the handles to each other, and how their reactivity influences the options on how the pieces could have come together.
- To develop tools to evaluate reactivity trends and to rationalize an outcome based on potential relationships to established paradigms.

Assessments & Grading Policy:

Problem Sets (PS): A select number of questions related to the current material will be distributed a week prior to being due. Although accuracy is encouraged, some questions may be graded based on effort, so full credit may be possible even if the answer is not perfect. However, reasonable outcomes based on indicated mechanistic actions and functional group trends will be essential in effort-based questions.

Mini Presentations (MP): Over the semester, there will be two opportunities for a short (~7 minute presentation) regarding an organic synthesis related topic. The goal is to be concise and clear when presenting your chosen subtopic. Further details, such as suggestions for format, will be forthcoming in addition to Dr. Hinze's grading rubric. The order of presenters for the first topic will be picked at random, and the order for the second topic will go in the reverse of the first. Swaps between students for presentation time must be approved by both individuals and Dr. Hinze informed in advance.

Peer Evaluations: Being able to provide both positive and constructive feedback on presentations is a crucial skill to develop, no matter what job sector you enter. After each in-class presentation, you will be asked to fill out a form then submit your typed out responses to Dr. Hinze by email prior to the next lecture. Evaluation points will be awarded based on participation, and the feedback will be shared anonymously with the presenter.

Exams: Two in-class exams will be given during the semester. Although concepts are cumulative, the focus will be on recently covered material. Question formats may have similarities to assigned problem sets and may include reaction schemes, mechanisms, or short answers.

Final Exam: The final exam is cumulative with a breakdown anticipated to be approximately 3/4 old exam content coverage and 1/4 newer content.

Exams* (Dates are tentative. May be adjusted depending on exact topic transitions.)

2/21, 4/4

Final Exam

Friday 5/6 10:15 am-12:15 pm

Overall Distribution of Course Points (450 points total):

Problem Sets (6):	90 points	20% of grade
Mini Presentations (2):	40 points	9% of grade
Peer Evaluations (2):	20 points	~4% of grade
Exams (2):	200 points	~44% of grade
Final Exam:	100 points	~22% of grade

-Grades will be determined based on the total points (pts) possible.
A ≥ 90% (405 pts), B ≥ 80% (360 pts), C ≥ 70% (315 pts), F ≤ 70%

-Prof. Hinze reserves the right to lower the cut-off for the letter grades at the end of the semester, but the letter grade thresholds will never be raised from those stated above.

-The policies, assignments, and schedule in the course are subject to change in the event of extenuating circumstances, by mutual agreement, and/or to ensure better student learning.

Late work policy:

Problem Sets: Will not be accepted after two calendar days from the original due date have passed. For each day overdue, 10% of the total points will automatically deducted each day. (e.g. A homework worth 15 points was submitted two days late. A score of 12 would have been awarded if submitted on time, but 1.5 points were deducted for each late day, thus the final score was 9 points.)

Office Hours:

Office hours provide an opportunity for you to ask me any questions you may have regarding the content of lectures or assignments, grading, or studying tactics. I am here to help facilitate your learning of organic chemistry by providing tools and coaching toward your success. If you would like to talk but cannot attend a designated office hour, feel free to correspond by email or request to schedule an individual meeting.

Academic Integrity:

All assignments and evaluations are assumed to be your own ideas or an interpretation of information available to you that has been properly referenced or cited. Plagiarism and blatant copying of the work of others will not be tolerated. If you have concerns regarding this policy, please schedule a one-on-one meeting with me. For official University policy, see <http://www.shsu.edu/syllabus/>

Accommodations:

If any assignments or exams conflict with religious holidays or a personal/family emergency arises, please inform me *by email* so that an alternative can be arranged. If an accommodation is needed for a disability, please let me know at your earliest convenience. Aspects of the course may be modified to facilitate your participation and progress. Any information provided is private and confidential and will be treated as such.

Mental Health and Stress Management:

Academic performance can be adversely impacted by stress, insufficient sleep, relationship complications, anxiety, substance abuse, depression, and other factors. Campus resources are available to provide support and guidance with these matters. Please visit <https://www.shsu.edu/dept/counseling/> for assistance or if you are concerned about another individual.

Course Schedule	<i>Tentative and Subject to Change</i>
Dates (by week)	Topics (representative but may not be all inclusive)
1/12-1/14	Synthesis Overview and Definitions, Retrosynthesis, Protecting Groups, [Atom] Economy (e.g. Mitsunobu)
1/19-1/21 *1/17 No Class	Oxidations: Carbonyl Formation (Alcohol oxidation), Ozonolysis, Dihydroxylation <i>PS 1 released 1/21</i>
1/24-1/28	Oxidations: Tamao-Fleming, Hydroboration, Epoxidation, Baeyer-Villiger, Ketone α C or allylic oxidation PS 1 due 1/28
1/31-2/4	Reductions: Hydrogenation, Carbonyl Reductions, Amine Formation, Dissolving Metals <i>PS 2 released 2/4</i>
2/7-2/11	Rearrangements: [3,3] Sigmatropic MP: Reaction or Chemist Highlight PS 2 due 2/11
2/14-2/18	Rearrangements: 1,2-Shifts, Heteroatom Nucleophiles C-C Bond Formation: Olefin Formation
2/21-2/25	C-C Bond Formation: Enolate Chemistry, Homologations Exam 1 on 2/21 <i>PS 3 released 2/25</i>
2/28-3/4	Synthesis Spotlight: Periplanone B, TBD PS 3 due 3/4
3/7-3/11	Construction of Rings: Diels-Alder, Robinson Annulation, Nazarov, Pauson-Khand, Three-membered Rings <i>PS 4 released 3/11</i>
3/14-3/18	Spring Break (No Class)
3/21-3/25	Construction of Heterocycles (and some Reactivity): Pyrrole, Furan, Triazole, Indole, Oxindole, Pyridine, Quinoline PS 4 due 3/25
3/28-4/1	Transition Metals in Synthesis: Metathesis, Heck, Wacker, sp^2 CX/Nucleophile Cross Couplings, 1,4-Additions
4/4-4/8	Radicals: Birch, Coupling, Barton-McCombie, S_{M12} , Tin Exam 2 on 4/4 <i>PS 5 released 4/6</i>
4/11-4/13 *4/15 No Class	Biocatalysis: p450s, Lipases, Aldolases, Transaminases PS 5 due 4/13*
4/18-4/22	Biocatalysis: Monoamineoxidases MP: Method or Synthesis Highlight <i>PS 6 released 4/22</i>
4/25-4/29	Biocatalysis: Reductases, Flavoenzymes, Polyketidesynthases PS 6 due 4/29
5/2-5/4	Synthesis Spotlight: TBD
5/6	Final Exam, 10:15 am-12:15 pm

Note: General topic areas are listed but some may be overlapped with each other. Specific examples in the synthesis spotlight will be determined at a later date.