

## SYLLABUS: Advanced Organic Chemistry

CHEM 432 | Fall 2022

T/Th, 11:30 am – 12:45 pm | Hashinger Science Center 019

**Instructor:** **Name:** Dr. Allegra Liberman-Martin  
**Email:** libermanmartin@chapman.edu  
**Office:** Keck Center for Science and Engineering, Room 236  
**Office Hours:** Thursdays 5:00 – 6:00 pm  
Fridays 12:00 pm – 1:00 pm

**Textbooks/Materials:** Pre-class videos and journal articles provided by the instructor.

**Course Description:** Prerequisites, Chem 331, 331L. This course teaches the detailed study of organic reaction mechanisms. Topics covered in this course may include the development of catalysts for organic reactions, the behavior of reactive intermediates, stereochemically controlled reactions, and the application of inorganic chemistry to organic reactions.

**Course-Wide Intended Learning Outcomes:** At the end of this course, each student will be able to:

- Relate the structure of a molecule to its expected properties and reactivity
- Predict or rationalize the outcome of a reaction based on molecular structure and chemical principles
- Propose a reasonable mechanism for an organic reaction using known reactivity patterns and experimental data
- Design experiments to test a proposed organic mechanism

**Program-Wide Intended Learning Outcomes:** In addition to the above learning outcomes, CHEM 331 supports, in part, the learning outcomes for the B.Sc. in Chemistry:

- Apply the scientific method to solve problems
- Demonstrate written, visual and oral presentation skills to communicate scientific knowledge
- Apply critical thinking and analytical skills to design and execute a scientific experiment, thoroughly analyze the results, and arrive at well-reasoned scientific conclusions.
- Demonstrate an understanding of core knowledge in chemistry

### Class Structure

Prior to each class time, you will be expected to:

- Watch the **pre-class video** (or complete the **pre-class reading**)
- Take the **pre-class quiz**.

During class, you will complete an **in-class worksheet** in groups with guidance from the instructor.

After each class, you will be expected to:

- Solidify your learning by completing the **assignments**.
- **Attend office hours** with questions you have on any of the concepts introduced in the pre-class materials, in-class worksheets, or assignments.

**Evaluation** Your grade in this course is based on your performance on the following:

Assessment	Date	Weighting (%)
Pre-class Quizzes	Frequently (due at 11:00 am before class)	10%
Assignments	Frequently (posted Thursdays after class)	75%
Final exam	Friday, Dec. 16 from 1:30 – 4:00 pm	15%

## SYLLABUS: Advanced Organic Chemistry

CHEM 432 | Fall 2022

T/Th, 11:30 am – 12:45 pm | Hashinger Science Center 019

**Pre-Class Quizzes:** An online quiz will be assigned before every class. Pre-class quizzes will be posted approximately 48 hours before the upcoming class and will be due at 11:00 am on the day of class. Pre-class quizzes are designed to assess your understanding of the assigned pre-class video or reading. There are no make-up quizzes and your lowest four pre-class quizzes will be dropped.

**Assignments:** Six assignments will be given throughout the semester (see schedule for dates). These assignments will extend your understanding of topics covered in the course and develop your problem-solving skills.

### Late submission policy:

10% reduction every 24 hours.

The assignment will receive a score of zero if not submitted within 3 days of the deadline.

### Revisions Policy for Assignments:

The goal of upper-division electives is to gain (and demonstrate) a deep understanding of a specialized area. Making mistakes is a natural part of learning and there is much to be gained by revising your work when it is incorrect rather than being provided the correct solution.

On assignments, you will be given the opportunity to revise incorrect answers. **For any questions you revise, you should include a sentence or two describing what went wrong the first time along with your revised answer.** Part of the goal is for you to figure out what was incorrect about your answer as well as fix it, so feedback on your initial assignment submission will be brief (either just the score for each question or possibly some brief notes/hints). An answer key for the assignment will not be provided until after revisions have been submitted.

Each assignment can only be revised once. If the revised score is lower than the original score, the better score will be kept.

The weighting of points allocated for assignments is:

First submission: 67%

Revised submission: 33%

For example: if a student received an 80% on their assignment first submission and 93% on the assignment revision, their overall score on the assignment would be 84.3%.

$$(80 \times .67) + (93 \times .33) = 84.3$$

**Final Exam:** A cumulative final exam will be given. Exam questions will be based on topics covered in pre-class videos, in-class worksheets, readings, or assignments.

**Make-Up Policy for Final Exam:** The only reasons that qualify for a make-up exam are: (1) serious illness with proper documentation (i.e., doctor's note or Dean of Students' letter), or (2) required attendance at an official University event with written notification to the professor prior to the exam and as early as possible.

**SYLLABUS: Advanced Organic Chemistry**  
CHEM 432 | Fall 2022  
T/Th, 11:30 am – 12:45 pm | Hashinger Science Center 019

**Course Academic Integrity Policy:** Your instructor for this course takes academic integrity very seriously. All suspected academic integrity violations will be investigated fully according to Chapman's Academic Integrity Policy.

**Authorizations Pre-Class Quizzes:**

- **You are authorized to:**
  - use all course materials (including pre-class videos) that your instructor has provided
  - collaborate with other students in the class
  - search the internet to gain a general understanding of concepts, but you should not consult SciFinder or primary literature articles for specific examples
- **You are not authorized to:**
  - post questions and/or seek solutions from internet "experts" (such as Chegg, CourseHero, Reddit, Stack Exchange, etc.)

**Authorizations for Assignments and the Final Exam:**

- **You are authorized to:**
  - use all course materials (including pre-class videos) that your instructor has provided
  - your notes
  - in-class worksheets
- **You are not authorized to:**
  - seek or share solutions with other students in the course until after the work has been graded and returned to you
  - use the internet (beyond the course Canvas resources)
  - post questions and/or seek solutions from internet "experts" (such as Chegg, CourseHero, Reddit, Stack Exchange, etc.)

The typical sanction for violating the course academic integrity policy is an 'F' in the course.

**Course Grading Rubric:**

Score (%)	Grade	Score (%)	Grade
92 – 100	A	72– 77	C
89 – 92	A–	69 – 72	C–
87 – 89	B+	67 – 69	D+
83 – 87	B	62 – 67	D
79 – 82	B–	59 – 62	D–
77 – 79	C+	< 59	F

**Course Electronic Access:** Course materials including the syllabus are available on Canvas. The Canvas site will be the primary repository of all documents for this class including pre-class videos, pre-class quizzes, worksheets, and assignments.

## SYLLABUS: Advanced Organic Chemistry

CHEM 432 | Fall 2022

T/Th, 11:30 am – 12:45 pm | Hashinger Science Center 019

**Academic Integrity Policy:** Chapman University is a community of scholars that emphasizes the mutual responsibility of all members to seek knowledge honestly and in good faith. Students are responsible for doing their own work and academic dishonesty of any kind will be subject to sanction by the instructor/administrator and referral to the university Academic Integrity Committee, which may impose additional sanctions including expulsion. Please see the full description of Chapman University's policy on Academic Integrity at [www.chapman.edu/academics/academicintegrity/index.aspx](http://www.chapman.edu/academics/academicintegrity/index.aspx).

**Students with Disabilities Policy:** In compliance with ADA guidelines, students who have any condition, either permanent or temporary, that might affect their ability to perform in this class are encouraged to contact the Disability Services Office. If you will need to utilize your approved accommodations in this class, please follow the proper notification procedure for informing your professor(s). This notification process must occur more than a week before any accommodation can be utilized. Please contact Disability Services at (714) 516-4520 or visit [www.chapman.edu/students/student-health-services/disability-services](http://www.chapman.edu/students/student-health-services/disability-services) if you have questions regarding this procedure or for information or to make an appointment to discuss and/or request potential accommodations based on documentation of your disability. Once formal approval of your need for an accommodation has been granted, you are encouraged to talk with your professor(s) about your accommodation options. The granting of any accommodation will not be retroactive and cannot jeopardize the academic standards or integrity of the course.

**Equity and Diversity Policy:** Chapman University is committed to ensuring equality and valuing diversity. Students and professors are reminded to show respect at all times as outlined in Chapman's Harassment and Discrimination Policy. Please see the full description of this policy at <http://www.chapman.edu/faculty-staff/human-resources/eoo.aspx>. Any violations of this policy should be discussed with the professor, the dean of students and/or otherwise reported in accordance with this policy.

**Student Support at Chapman University:** Over the course of the semester, you may experience a range of challenges that interfere with your learning, such as problems with friend, family, and or significant other relationships; substance use; concerns about personal adequacy; feeling overwhelmed; or feeling sad or anxious without knowing why. These mental health concerns or stressful events may diminish your academic performance and/or reduce your ability to participate in daily activities. You can learn more about the resources available through Chapman University's Student Psychological Counseling Services here: <https://www.chapman.edu/students/health-and-safety/psychological-counseling/>

**Food Pantry Assistance:** If you or a student you know could benefit from access to the food pantry or would like more information on the food pantry program, contact the Dean of Students at (714) 997-6721.

**SYLLABUS: Advanced Organic Chemistry**  
CHEM 432 | Fall 2022  
T/Th, 11:30 am – 12:45 pm | Hashinger Science Center 019

**Tentative Schedule:**

Week	Day	Date	Topic
1	T	8.30	<b>Bonding Theories I:</b> Atomic Orbitals, VSEPR, Hybridization
	Th	9.01	<b>Bonding Theories II:</b> Molecular Orbital Theory
2	T	9.06	<b>Bonding Theories III:</b> Frontier Molecular Orbitals
	Th	9.08	<b>Bonding Theories IV:</b> Reactive Carbon Intermediates (Carbocations, Carbanions, Radicals, and Carbenes)
<b>Assignment 1 – released Thursday, Sept. 08 (covers Weeks 1–2)</b>			
3	T	9.13	<b>Thermodynamics I:</b> Gibbs Free Energy, Van't Hoff Plots
	Th	9.15	<b>Thermodynamics II:</b> Stability & Persistence
<b>Assignment 1 Revisions</b>			
4	T	9.20	<b>Conformational Analysis:</b> Acyclic systems, 6-Membered Rings, Anomeric Effect
	Th	9.22	<b>Kinetics I:</b> Rates and Rate Constants, Reaction Coordinate Diagrams
<b>Assignment 2 – released Thursday, Sept. 22 (covers Weeks 3–4)</b>			
5	T	9.27	<b>Kinetics II:</b> Transition State Theory, Activation Parameters
	Th	9.29	<b>Kinetics III:</b> Principles Related to Kinetic Analysis
<b>Assignment 2 revisions</b>			

**SYLLABUS: Advanced Organic Chemistry**  
CHEM 432 | Fall 2022  
T/Th, 11:30 am – 12:45 pm | Hashinger Science Center 019

**6** T 10.04 **Kinetics IV:** Kinetics Experiments

Th 10.06 **Kinetics V:** Multistep Reactions

**Assignment 3 – released Thursday, Oct. 06 (covers Weeks 5–6)**

**7** T 10.11 **Mechanistic Experiments I:** Primary Kinetic Isotope Effects

Th 10.13 **Mechanistic Experiments II:** Secondary Kinetic Isotope Effects, Equilibrium Isotope Effects

**Assignment 3 revisions**

**8** T 10.18 **Mechanistic Experiments III:** Hammett Plots

Th 10.20 **Mechanistic Experiments IV:** Competition Experiments, Cross-Over Experiments, Stereochemical Analysis, Isotope Scrambling, Radical Clocks

**Assignment 4 – released Thursday, Oct. 20 (covers Weeks 7–8)**

**9** T 10.25 **Alkene Reactions:** Halogenation, Epoxidation

Th 10.27 **Carbene Reactions:** Alkene Addition, C–H Bond Insertion

**Assignment 4 revisions**

**10** T 11.01 **Aromatic Substitution Reactions:** Electrophilic Aromatic Substitution, Nucleophilic Aromatic Substitution, Benzyne Reactions

Th 11.03 **Literature Article Discussion**

**Assignment 5 – released Thursday, Nov. 03 (covers Weeks 9–10)**

**SYLLABUS: Advanced Organic Chemistry**  
CHEM 432 | Fall 2022  
T/Th, 11:30 am – 12:45 pm | Hashinger Science Center 019

**11** T 11.08 **S<sub>N</sub>2 and S<sub>N</sub>1 Reactions:** Kinetics, Competition Experiments, Stereochemistry, Solvent Effects

Th 11.10 **NO CLASS**

**Assignment 5 revisions**

**12** T 11.15 **S<sub>N</sub>1 Reactions II:** Carbocation Rearrangements, Anchimeric Assistance

Th 11.17 **Rearrangements I:** Pinacol Rearrangement, Benzylic Acid Rearrangement, Beckman Rearrangement

**THANKSGIVING BREAK! Nov 21rd – 25th**

**13** T 11.29 **Rearrangements II:** Radical Hydrogen Shifts, Radical Aryl and Vinyl Shifts, and Radical Ring-Opening Reactions

Th 12.01 **Literature Article Discussion**

**Assignment 6 – released Thursday, Nov. 17 (covers Weeks 11–12)**

**14** T 12.06 **Rearrangements III:** Reactions Involving Biradical Intermediates

Th 12.08 **Review**

**Assignment 6 revisions**

**15** **Final exam – due Friday, December 16**