

**Advanced Organic Chemistry
Chemistry 511
Spring 2022**

Wednesday 6:00-8:50 PM, Smith 241

Instructor: Prof. Stacey Brenner-Moyer (<http://www.brennermoyer.com/>)

Contact Information: seb244@newark.rutgers.edu

Office Hours: Wednesdays 4:30-5:30 PM in Room 201E Life Sciences Building

Course Description:

This physical organic chemistry course builds upon the basic organic reaction mechanisms taught in undergraduate and introductory graduate coursework. We will learn about the experimental tools employed to derive the fundamental organic reaction mechanisms that have come to be accepted as fact, and we will evolve our understanding of organic reaction mechanisms beyond the simplified versions presented in undergraduate textbooks. Specifically, the physical chemistry experimental tools to be emphasized include molecular orbital theory, kinetic data, linear free-energy relationships, and isotope effects. We will learn how these data are integrated to provide comprehensive, self-consistent, and sophisticated models for the reactivity of organic molecules.

For students planning to continue studying organic chemistry, this course will provide the foundation for rationalizing and predicting advanced organic reaction mechanisms. For students planning to study other areas of chemistry, this course will provide insight into the relevance of methods used in other fields of chemistry to organic chemistry, as well as into the rational design of experiments to test scientific hypotheses.

Learning Goals:

Upon completion of the course, students should be able to:

- Predict relative thermodynamic, kinetic, and stereochemical outcomes of selected reactions.
- Interpret thermodynamic, kinetic, and stereochemical data to draw reasonable conclusions with respect to reaction mechanisms.
- Illustrate the mechanism of selected reactions.

Required Texts and Materials:

1. Carey, Francis A.; Sundberg, Richard J. *Advanced Organic Chemistry, Part A: Structure and Mechanism*. 5th ed. Springer, 2007.

NOTE: This book can be downloaded for FREE from campus or login via Rutgers account:
<https://link-springer-com.proxy.libraries.rutgers.edu/book/10.1007%2F978-0-387-44899-2>

Recommended Materials:

1. Molecular Model Set for Organic Chemistry, Prentice Hall

Course Evaluation:

Your grade for the course will be determined as follows:

Problem Sets: 50%

Presentation: 25%

Final Exam: 25%%

Problem sets: There will be two graded problem sets for this course.

- Problem set 1: The practice problems for Chapter 3 (below) will comprise problem set 1. These will be due one week after the lecture on Chapter 3, prior to the beginning of class on February 16. Prof. Brenner-Moyer will randomly select a maximum of 6 out of the 12 practice problems to grade.
- Problem set 2: Questions for problem set 2 will be derived from the lectures covering, and practice problems for, Chapters 4-9. Consider this problem set as a practice final exam, although, in contrast to the final exam, you need not work independently. This problem set will be distributed by Apr. 10, and will be due by Apr. 17.

Presentation: Each student will select a paper from the recent (i.e., last ten years) literature that utilizes some of the principles introduced in Chapter 3 (i.e., Hammett correlations, kinetic isotope effects, solvent [isotope] effects, specific/general acid catalysis) to provide insight into an organic chemistry reaction mechanism. As an example of a suitable paper choice, see: Huq, S. R.; Shi, S.; Diao, R.; Szostak, M. "Mechanistic study of $\text{SmI}_2/\text{H}_2\text{O}$ and $\text{SmI}_2/\text{amine}/\text{H}_2\text{O}$ -promoted chemoselective reduction of aromatic amides (primary, secondary, tertiary) to alcohols via aminoketyl radicals." *J. Org. Chem.* **2017**, *82*, 6528-6540. (Note: This paper may be selected by a student.) Students must OK their choice of paper with Prof. Brenner-Moyer. Students will then prepare and present a 15-20 minute power point lecture on their paper selection. Thoroughness of material covered, accuracy of information conveyed, and quality of oral presentation will factor heavily into the grading of the presentation.

Final Exam: Exam questions will be derived from lecture notes, practice problems, and problem sets.

Policy for Absence from Exams or Illness During Exams: In the event of an excused absence on the scheduled date of the presentation, the presentation will be given the following week. In the event of an absence that is not deemed by Prof. Brenner-Moyer to be excused, a grade of "0" will be recorded for the presentation. In the event of an excused absence from the final exam, contact Professor Brenner-Moyer as soon as possible. In the event of an absence that is not deemed by Professor Brenner-Moyer to be excused, a grade of "0" will be recorded for the final exam.

Issues of Courtesy: Lecture will start as scheduled, at 6:00 PM. Please try to arrive on time, with your electronic devices turned off. If you must arrive late to lecture, please enter quietly, so as not to disrupt those who were on time and are listening intently.

Please note: There will be a 15 minute break during every lecture.

Practice Problems:

Ch. 1: 1a, 2a,d, 4, 5, 8, 9, 11, 12c, 15, 16, 17, 19

Ch. 2: 1, 5, 6, 7, 8, 10, 12, 14, 16, 23a, 26c,d,f,h,l, 30

Ch. 3: 1b, 3, 5, 6, 7b, 8, 10, 12, 13, 19, 20, 23

Ch. 4: 2b,d,f, 3, 8, 9, 11, 13a,e, 14, 16, 20, 21, 23, 26

Ch. 5: 1, 4, 6, 8, 12, 13, 14, 15, 17, 19

Ch. 6: 2, 3, 7, 8, 9, 10, 13, 15, 16, 18b, 24

Ch. 7: 1, 2b,c, 9, 10c,e, 11, 15, 17, 20, 21, 24, 25, 26

Ch. 8: 2, 4, 7, 8, 10, 11, 13, 14, 15, 18

Ch. 9: 1, 2, 3, 4, 6, 8, 11, 14, 15, 17, 19a, c

Ch. 10: 1, 2a,b,c, 4, 6, 7c,d,f,g, 10, 12, 13, 14b,d,e, 15, 17, 18, 21

Ch. 11: 3, 4, 5, 8, 9, 13, 17, 18, 19, 20

Ch. 12: 2b,3b,4a-e,8,13,17,19,21

Tentative Schedule of Course Topics, Exams and Reading Assignments:

<u>Week</u>	<u>Date</u>	<u>Topic</u>	<u>Reading</u>
1	Wed. Jan. 19	Chemical Bonding and Molecular Structure <i>~virtual lecture~</i>	1.1 – 1.2
2	Wed. Jan. 26	Stereochemistry, Conformation, and Stereoselectivity <i>~virtual lecture~</i>	2.1
3	Wed. Feb. 2	Stereochemistry, Conformation, and Stereoselectivity	2.2-2.3
4	Wed. Feb. 9	Structural Effects on Stability and Reactivity	Chapter 3
5	Wed. Feb. 16	Nucleophilic Substitution <i>~Problem set 1 due by beginning of lecture~</i>	Chapter 4
6	Wed. Feb. 23	Polar Addition and Elimination Reactions	5.1 – 5.3, 5.6, 5.9-5.10
7	Wed. Mar. 2	Carbanions and Other Carbon Nucleophiles	6.1, 6.3-6.5
8	Wed. Mar. 9	Addition, Condensation and Substitution Reactions of Carbonyl Compounds	7.1 – 7.2
9	Wed. Mar. 23	<i>~Student presentations~</i>	
10	Wed. Mar. 30	Aromaticity and Aromatic Substitution	8.1 – 8.3, 9.1 – 9.5
11	Wed. Apr. 6	Concerted Pericyclic Reactions	10.1 – 10.6
12	Wed. Apr. 13	<i>~No lecture~</i> <i>~Problem set 2 distributed and due Apr. 17~</i>	
13	Wed. Apr. 20	Free Radical Reactions	11.1 – 11.6
14	Wed. Apr. 27	Photochemistry	Chapter 12
	Wed. May 11	FINAL EXAM (6-9pm)	ALL CHAPTERS

Academic Integrity: As an academic community dedicated to the creation, dissemination, and application of knowledge, Rutgers University is committed to fostering an intellectual and ethical environment based on the principles of academic integrity. Academic integrity is essential to the success of the University's educational and research missions, and violations of academic integrity constitute serious offenses against the entire academic community. The entire Academic Integrity Policy can be found here: <http://academicintegrity.rutgers.edu/academic-integrity-policy/>

Accommodations and Support: Rutgers University Newark (RU-N) is committed to the creation of an inclusive and safe learning environment for all students. RU-N has identified the following resources to further the mission of access and support:

- **Students with Disabilities:** Rutgers University welcomes students with disabilities into all of the University's educational programs. The Office of Disability Services (ODS) is responsible for the determination of appropriate accommodations for students who encounter barriers due to disability. In order to receive consideration for reasonable accommodations, a student with a disability must contact ODS, register, have an initial appointment, and provide documentation. Once a student has completed the ODS process (registration, initial appointment, and documentation submitted) and reasonable accommodations are determined to be necessary and appropriate, a Letter of Accommodation (LOA) will be provided to the student. The student must give the LOA to each course instructor, followed by a discussion with the instructor. This should be completed as early in the semester as possible as accommodations are not retroactive. More information can be found at ods.rutgers.edu. Contact ODS: (973) 353-5375 or ods@newark.rutgers.edu.
- **Religious Holiday Policy and Accommodations:** Students are advised to provide timely notification to instructors about necessary absences for religious observances and are responsible for making up the work or exams according to an agreed-upon schedule. The Division of Student Affairs is available to verify absences for religious observance, as needed: (973) 353-5063 or DeanofStudents@newark.rutgers.edu.
- **Counseling Services:** Counseling Center Room 101, Blumenthal Hall, (973) 353-5805 or <http://counseling.newark.rutgers.edu/>.
- **Students with Temporary Conditions/Injuries:** Students experiencing a temporary condition or injury that is adversely affecting their ability to fully participate in their courses should submit a request for assistance at: <https://temporaryconditions.rutgers.edu>.
- **Students Who are Pregnant:** The Office of Title IX and ADA Compliance is available to assist students with any concerns or potential accommodations related to pregnancy: (973) 353-1906 or TitleIX@newark.rutgers.edu.
- **Gender or Sex-Based Discrimination or Harassment:** Students experiencing any form of gender or sex-based discrimination or harassment, including sexual assault, sexual harassment, relationship violence, or stalking, should know that help and support are available. To report an incident, contact the Office of Title IX and ADA Compliance: (973) 353-1906 or TitleIX@newark.rutgers.edu. To submit an incident report: tinyurl.com/RUNReportingForm. To speak with a staff member who is confidential and does **NOT** have a reporting responsibility, contact the Office for Violence Prevention and Victim Assistance: (973) 353-1918 or run.vpva@rutgers.edu.