

CHEMISTRY 232 – ORGANIC CHEMISTRY II

FALL 2019

TR 8:10-9:30 or TR 9:40-11:00 am, TOM 101

Instructor: Professor Mo Hunsen

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Office Telephone: 427-5091

Office Hours: W 11:30 am – 1:30 pm, R 12-2 pm, or by drop-in/appointment. You are welcome, encouraged, and expected to meet with me throughout the semester.

Text: Vollhardt, K. Peter C.; Schore, Neil E. "Organic Chemistry: Structure and Function," 6th ed.

Optional: Schore, Neil E. "Study Guide and Solutions Manual for Organic Chemistry," 6th ed.

Point Distribution:

2 Midterm Exams	200
Best 6 out of 7 Quizzes @ 10 points each	60
Literature Homework Assignment (Due: TBA)	60
Class participation	50
ACS Standardized Exam	30
Final Exam	100

Total	500

Exam Schedule:

Midterm Exam I	Topics covered before Oct. 8 th	Oct. 8
Midterm Exam II	Topics covered before Nov. 14 th	Nov. 14
ACS Exam	Comprehensive	Dec. 6
Final Exam	Comprehensive with a focus on topics not covered in mid-term exams	see Final exam schedule.

Goals: Chemistry 232 provides a foundation of knowledge for other science courses at Kenyon, such as Advanced Chemistry (Chem 401), Biochemistry (Chem 256), and Molecular Biology (Biol 263). It is one of the elective advanced courses in chemistry. In addition, by the end of the semester you should be able to read and understand a large amount of the current published original research in organic chemistry.

Attendance: As you already know by now from your experience in Chemistry 231, it is quite easy to get behind if you miss a topic. Therefore, other than excused absences, class attendance is mandatory.

Prerequisite: Organic chemistry is a science that continually builds upon itself, and this course is acutely dependent upon your working knowledge of Chemistry 231 material.

ATTENTION: The final exam of this course **will** contain topics from Chemistry 231.

Studying: You should devote *9 hours minimum* per week to studying for this course outside of our normal meeting time. This includes office hours, MSSC hours and time for the group project. Suggested exercises assigned within each chapter should be solved as you read the text, and the appropriate problems located at the end of each chapter should be worked on soon after the text section has been covered (see the **Tentative Schedule and Reading Assignments** on the next page). While the suggested exercises and problems from the text will not be turned in to be graded, I strongly recommend that you do them regularly and earnestly. After making a real effort to work each assigned exercise or problem, the answer should be consulted in Appendix A of the text (exercises) or the Study Guide and Solutions Manual (problems). Students unable to solve an exercise or problem are encouraged to ask me for help! The tutor of this course will arrange a convenient time and place for review sessions.

Learning Goals: Students will understand:

1. the nomenclature, structure, preparation, and reactivity of aldehydes and ketones including their condensation reactions.
2. the nomenclature, structure, preparation, and reactivity of carbohydrates and other biomolecules (e.g. amines and amino-acids).
3. the nomenclature, structure, preparation, and reactivity of conjugated and aromatic systems including the Diels-Alder reaction, and electrophilic & nucleophilic aromatic substitutions).
4. the nomenclature, structure, preparation, and reactivity of carboxylic acids and their derivatives including the effect of substituents on their reactivity and pKa.
5. reaction mechanisms and stereochemistry for the chemistry of the above classes of molecules and be able to propose multiple approaches for their synthesis.
6. how to formulate and solve syntheses problems individually and as a member of a group.
7. ways of searching for primary articles in organic chemistry; and evaluating and using these information to write concise & clear reports as well as giving effective oral presentations.

Quizzes: A quiz will be given on Fridays (See **Tentative Schedule**). Some quizzes will be of the "take home" variety and may be worked on individually or in pairs over the weekend.

Group Project: A group project that focuses on topics relevant to that covered in class will be assigned. The deliverables include an oral presentation (10 minutes) and a report (approximately 4-6 typewritten pages). The report is to be typewritten using the template provided by the instructor and will be due a week after your in-class presentation. All structures must be drawn using ChemDraw which is a free download at <http://scistore.cambridgesoft.com/sitelicense.cfm>.

Academic Integrity: At Kenyon we expect all students, always, to submit work that represents the highest standards of academic integrity. It is the responsibility of each student to learn and practice the proper ways of documenting and acknowledging those whose ideas and words they have drawn upon (see Academic Honesty and Questions of Plagiarism in the Course Catalog). Ignorance and carelessness are not excuses for academic dishonesty. If you are uncertain about the expectations for this class, please ask for clarification.

Electronic Device Policy: Active participation and full engagement is critical for your success in this course. As such all electronic devices should be turned off before the beginning of every class.

Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990: Students who anticipate they may need accommodations in this course because of the impact of a learning, physical, or psychological disability are encouraged to meet with me privately early in the semester to discuss their concerns. In addition, students must contact Erin Salva, Director of Student Accessibility and Support Services (740-427-5453 or salvae@kenyon.edu), as soon as possible, to verify their eligibility for reasonable academic accommodations.

Title IX Responsibilities: As a faculty member, I am deeply invested in the well-being of each student I teach. I am here to assist you with your work in this course. If you come to me with non-course-related concerns, I will do my best to help. It is important for you to know that all faculty members are mandated reporters of any incidents of harassment, discrimination, and intimate partner violence and stalking. Meaning, I cannot keep information involving sexual harassment, sexual misconduct, interpersonal violence, any other form of harassment or discrimination based on a protected characteristic confidential. The Health and Counseling Center, the College chaplains, and the staff at New Directions Domestic Abuse Shelter & Rape Crisis are confidential resources.

This syllabus is subject to change at my discretion. I will notify you of any changes in class and/or by email.

ALDEHYDES AND KETONES

	Tentative Schedule of Topics	Read	Quiz
8/29 & 9/3	Structure, Nomenclature, and Preparation of Aldehydes and Ketones Addition Reactions of Aldehydes and Ketones / Acetals	17-1, 17-2, 17-4 17-5 to 17-8	
9/5 & 9/10	Acetals as Protecting Groups / Desulfurization Imines and Enamines; Wolff-Kishner Reduction / Cyanohydrins	17-9 to 17-11	Q
9/12 & 9/17	The Wittig Reaction / The Baeyer-Villiger Oxidation Keto-Enol Equilibria / Deuterium Exchange / Stereoisomerization Halogenation and Alkylation of Aldehydes and Ketones	17-12, 17-13 18-2 to 18-4	
9/19 & 9/24	The Aldol Addition Reaction and Condensation / Crossed Aldol Condensation Intramolecular Aldol Condensation / Conjugate Addition The Michael Addition / The Robinson Annulation	18-5, 18-6 18-7 to 18-10 18-11	Q

CARBOHYDRATES

9/26 & 10/1	Nomenclature, Structure, and Conformation of Monosaccharides The Mutarotation of Glucose / Oxidation and Reduction of the "Open-Chain Form" of Monosaccharides; The Kiliani-Fischer Synthesis / The Ruff Degradation	24-1, 24-2 24-3 to 24-7	Q
10/3	Reactions of the "Cyclic Form" of Monosaccharides / Disaccharides / Polysaccharides Introduction to amino acids and peptides (if time allows)	24-8 to 24-12 26	
10/8	Midterm Exam I		

ALKENES, DIENES, AND AROMATICS

10/15 & 10/17	Alkenes: Catalytic Hydrogenation; Addition of HX; Radical Addition of HBr More Electrophilic Additions; Oxymercuration-Demercuration; Hydroboration-Oxidation;	12-2 to 12-7	
10/22 & 10/24	Alkenes: Epoxide Formation; Dihydroxylation; Ozonolysis Dienes: Stability of Dienes / The Diels-Alder Reaction	12-8 to 12-12 14-5, 14-8	
10/29 & 10/31	Aromatics: Structure, Resonance Energy, and Nomenclature of Benzenes, Aromaticity; Electrophilic Aromatic Substitution: Halogenation, Nitration, and Sulfonation; The Friedel-Crafts Reactions	14-7, 15-1, 15-2, 15-5 to 15-7 15-8 to 15-13	Q
11/5 & 11/7	Electrophilic Attack on Substituted Benzenes: Control of Regioselectivity; Electrophilic Attack on Disubstituted Benzenes / Dissolving-Metal Reductions	16-1 to 16-5	Q
11/12	Synthetic Strategies / Electrophilic Attack on Naphthalene and its Derivatives; Nucleophilic Aromatic Substitution; Cope & Claisen Rearrangement	16-5, 16-6 22-4, 22-6, 22-7	
11/14	Midterm Exam II		

CARBOXYLIC ACIDS AND THEIR DERIVATIVES

11/26 & 11/28	Nomenclature and Physical Properties of Carboxylic Acids Acid-Base Properties and Preparation of Carboxylic Acids Preparation of Acyl Halides, Anhydrides, and Esters / The Fischer Esterification	19-1, 19-2 19-4, 19-6 19-8, 19-9	Q
12/3	Preparation of Amides, Alcohols, and α -Bromocarboxylic Acids / The Hell-Volhard-Zelinsky Reaction The Addition-Elimination Mechanism / Reactions of Acyl Halides	19-10 to 19-12 19-7, 20-1, 20-2	Q
12/5	ACS Exam		
12/10 & 12/12	Reactions of Anhydrides and Esters Reactions of Amides and Nitriles / The Hofmann Rearrangement Claisen and Dieckmann Condensations, Acetoacetic and Malonic Ester Syntheses	20-3, 20-4 20-6 to 20-8 23-1, 23-2	