Chemistry 231 – Organic Chemistry I

Course Description:

Organic chemistry is the study of the structure, properties, and reactions of molecules containing carbon. The prominence of carbon containing molecules, organic molecules, in our everyday life may explain why organic chemistry is such a rich discipline. Much of what we wear, smell, eat, build, burn, and touch during our lives is composed of organic molecules. We ourselves and all other life we know are based on compounds of carbon.

Why has carbon adopted such a central role in our lives and life itself? One reason is that carbon is a versatile and promiscuous element. It is capable of bonding to itself and other elements in a multitude of ways. One indication of carbon's versatility is the fact that tens of millions organic compounds have been described and thousands of new compounds are described every day.

This course is the first of a two-course sequence designed to introduce students to the theoretical underpinnings of organic chemistry. We will begin by exploring how organic molecules are held together, learn to identify the key functional groups, and develop an understanding of how spectroscopy is used in determining the structure organic molecules. For the remainder of the year, we will take an in-depth look at the chemistry and properties of a number of functional groups. During our study you will acquire the tools to design a synthesis for simple organic molecules. You will also learn how to employ familiar concepts from thermodynamics and kinetics to predict both the products that are likely to form in an organic reaction and the detailed course of events that leads to their formation.

Instructor and Resources:

Instructor:	Dr. John Hofferberth
Email:	hofferberthj@kenyon.edu
Office:	312 Tomsich Hall
Office Hours:	Monday 2-3 PM (one on one, < 10 min/appointment) Monday 3-4 PM (small group) Wednesday 2-3 PM (one on one, < 10 min/appointments) Wednesday 3-4 PM (small group) Thursday 6-7 PM (review session, RBH 109) Friday 3-4 PM (small group)
Lecture Hall:	Hayes 109
Class Time:	Section 1: 8:10 – 9:00 AM, MWF Section 2: 9:10 – 10:00 AM, MWF
Text:	Organic Chemistry, 6th Ed, Vollhardt and Shore (optional study guide)
Materials:	HGS Molecular Structure Model (Kit C)
Recommended Reading:	Make it stick: the science of successful learning, Brown, Roediger, and McDaniel, ©2014 Harvard University Press
Website:	moodle.kenyon.edu (search for Chemistry 231 once you have logged in)

Course Policies and Expectations:

Course Grade: Your grade in the course will be determined by your performance on quizzes, midterms and the final. The point breakdown that will be used is provided below:

Quizzes (12 × 10 pts each)	120 pts
Midterm Exams (3 × 100 pts)	300 pts
Final Exam	150 pts
Preparation and Engagement	30 pts
Total Points	**600 pts**

The following grading scheme can be used to estimate your grade. The instructor will assign fair and appropriate grades at his discretion.

Grade	Percent of Total Points Earned
A (+/-)	100% - 90%
B (+/-)	89% - 80%
C (+/-)	79% - 70%
D (+/-)	69% - 60%
F	< 60%

Attendance: *Your attendance at every lecture is expected.*

Preparation: *The material in this course builds on itself. For that reason it is imperative that you keep up with all aspects of the course and seek help immediately if you need it.*

You can get help on any aspect of the course from the following sources:
1) The instructor (office hours, review sessions or by appointment)
2) The Math and Science Skills Center (101 Tomsich; Sunday, Tuesday, and Thursday 7:00 - 10:00 PM). There should always be a tutor able to help with organic questions available at the MSSC. We will also have a lead tutor for this class, Alex Oles, who will hold two office hours each week at the MSSC (Tuesday, 8-10 PM).

Thursday Evening Review Sessions: Dr. Hofferberth will lead a weekly review/study session on Thursday evenings between 6:00 and 7:00 PM in RBH 109. These sessions are entirely optional and the content will be directed by student questions. The review sessions will end promptly at 7:00 PM and students with additional questions can make use of the Thursday hours for the Math and Science Skills Center (7:00 – 10:00 PM). If these sessions are poorly attended the instructor reserves the right to discontinue them.

Homework and Suggested Problems:

The best way to master organic chemistry is to test yourself regularly with a diverse set of practice problems, honestly assess your performance, and focus attention on the things you miss. Suggested problems are indicated on the syllabus for each unit covered. Completing the suggested problems, returning repeatedly to problems from earlier in the course (easy and hard alike), and mixing up the order that you attempt practice problems will increase your durable learning and lead to better performances on quizzes and examinations. Testing yourself regularly with additional problems in the text (or in other organic chemistry texts) is a valuable use of your preparation time for this class.

A specific homework assignment will be posted after each lecture on the Moodle Forum and texted to students via Remind. Homework assignments may include a set of suggested problems from the text, practice problems prepared by the instructor and linked to course Moodle page, webcasts, and/or a reading assignment.

Quizzes:

Quizzes are an important learning tool. A quiz will be given during the first 5 minutes and last 2 minutes of class every day except for the day of exams. All quizzes will be turned in. Quizzes that take place at the beginning of class on Friday will earn a grade (10 pts possible). All other quizzes will contribute to your preparation and engagement grade (30 pts *for the semester*). There will be no make-up quizzes but quizzes missed during excused absences will not impact your final grade (total points possible will be reduced). Organic chemistry builds upon itself and, for that reason, quizzes will be cumulative.

Midterm Exams:

Three cumulative in-class midterm examinations will be given during the semester (dates indicated on the syllabus). Seating for the in-class portion of the exam will be assigned by the instructor as students enter the exam room. Model kits may be used on all exams in this course. If you have a conflict with any of the exam times you must notify Dr. Hofferberth in writing ***at least one week prior to the exam to schedule an alternate exam time.***

Final Exam:

The final exam will be cumulative and closed-note. Students will be given three hours to complete the final exam. The date and time of the final is indicated on the tentative schedule (below).

Accommodations: In accord with ***Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990***: If you anticipate you may need accommodation in order to fully participate in this class, please identify yourself to Erin Salva, Director of Student Accessibility and Support Services (PBX 5453, salvae@kenyon.edu). *The instructor must receive information regarding the nature of the accommodation directly from Erin Salva and you must speak to the instructor about the accommodation at least one week in advance of using the accommodation for the class.*

Academic Integrity: Academic integrity is expected in all aspects of this course. A detailed description of academic integrity and the College policy regarding academic dishonesty can be found in the Course Catalog at the following link: http://www.kenyon.edu/directories/offices-services/registrar/course-catalog-2/administrative-matters/academic-integrity-and-questions-of-plagiarism/

Electronic Device Policy: Full engagement with the lecture portion of this course will be a key component of success. All electronic devices should be turned off before the beginning of every lecture.

Title IX: Kenyon College and the instructor of this course seek to provide an environment that is free of bias, discrimination, and harassment. If you have been the victim of sexual harassment/misconduct/assault we encourage you to report this. If you report this to the instructor, he must notify our college's Title IX coordinator about the basic facts of the incident (you may choose whether you or anyone involved is identified by name). For more information about your options at Kenyon, please go to: http://www.kenyon.edu/directories/offices-services/office-of-equal-opportunity/sexual-assault-and-harassment/

Tentative Schedule:

Date	Topics	Reading (Suggested Problems)
8/28 8/31 9/2	**Chapter 1:** UN Number Valence Bond Theory Representing Organic Molecules Formal Charge	Read: Chapter 1 – all, Chapter 11.11 Videos: 1, 2, 3, 4 with practice Problems (Ch 1): 29, 31, 35, 36, 37, 38, 40, 42, 43, 44, 45 Problems (Ch 11): 24, 62 Practice Handouts: Hybridization, FG Practice
9/4 9/7 9/9 9/11 9/14	**Chapter 2:** Functional Groups Thermodynamics Kinetics Reaction Coordinate Diagrams Conformational Analysis Acid and Base Chemistry Electrophiles and Nucleophiles	Read: Chapter 2 – all Videos: 5, 6 with practice Problems (Ch 2): 27-36, 42-45 Practice Handouts: pKa estimation and extra practice, UN Pool Diversity Practice
9/16 9/18 9/21 9/23 9/25	**Chapters 10 & 11:** IR & NMR	Read: Chapter 10 – all, Chapter 11.8 Problems (Ch 10): 29, 32-40, 43-45, 47, 54, 55, 58; (Ch 11): 34, 35, 51, 55, 57 Practice Handouts: Spectral Data Analysis Online Practice: Webspectra Assignment (Moodle)
9/28	**Exam 1**	
9/30 10/2	**Chapter 3:** Alkanes Alkane Physical Properties Bond Strength and Rationale Hyperconjugation Mechanism Radical Chain Mechanism Hammond's Postulate Halogenation of Higher Alkanes Combustion of Alkanes	Read: Chapter 3.1, 3.2, 3.4-3.8, 3.10 Problems (Ch 3): 20-28, 30, 31, 34 Videos: 7, 8 with practice
10/5 10/7	**Chapter 4:** Cycloalkanes Combustion Strain and Structure Conformational Analysis Polycyclic Alkanes Physical Properties Naming	Read: Chapter 4 – all Problems (Ch 4): 21, 23-27, 29-33, 36, 39
10/9	October Break	
10/12	**Chapter 4**: Continued	
10/14	**Chapter 5**: Stereochemistry	Read: Chapter 5.1-5.3, 5.5-5.8

10/16 10/19 10/21	Isomer Hierarchy Chirality Absolute Configuration Optical Activity Diastereomers and Meso Stereochemistry of Reactions Fischer Projections (brief) Obtaining a single isomer	Problems (Ch 5): 33-37, 38 (all but upper right), 41, 43, 45, 48-50, 53, 58-61 63
10/23 10/26 10/28	**Chapter 6:** Haloalkanes I SN2 Physical Properties and Structure	Read: Chapter 6 – all Problems (Ch 6): 31-33, 38 (not C), 39, 41-44, 45-49 (respond two ways for each: polar protic, polar aprotic) Video 9
10/30	**Exam 2**	
11/2 11/4 11/6 11/9 11/11	**Chapter 7**: Haloalkanes II SN1, E1, E2 Regiochemistry E1CB and Biological Elimination Competition	Read: Chapter 7 – all, Chapter 11.6, 11.7 Problems (Ch 7): 25-49; (Ch 11): 39-41, 49, 50 Handout: Competition Practice
11/13 11/16 11/18 11/20	**Chapter 8**: Alcohols I Structure and Physical Properties Acid-Base Properties Preparation of Alcohols Oxidation of Alcohols Naming	Read: Chapter 8.1-8.3, 8.5-8.9 Problems (Ch 8): 24-28, 30, 33-35, 36 (not a), 37-40, 42-48, 53, 54
11/21-11/27	**Thanksgiving Break**	
11/30 12/2	**Chapter 9:** Alcohols II Retrosynthesis Synthesis of Alkyl Halides Carbocation Rearrangements Dehydration Ether Synthesis Reactions of Ethers Sulfur Compounds Naming	Read: Chapter 9.1 – 9.10 Problems (Ch 9): 28-59 Handouts: Synthesis Challenges
12/4	**Exam 3**	
12/7 12/9 12/11	**Chapter 9:** Continued	
12/17	**Final Exam Section 1 (231.01), 1:30-4:30PM, RBH 109**	
12/17	**Final Exam Section 2 (231.02), 6:30-9:30PM, RBH 109**	