CHEM 261: ORGANIC CHEMISTRY LECTURE SYLLABUS

Instructor: Dr. Zachary Rodgers  
Course webpage: Desire2Learn  
Contact Info: (724)-946-6289  
Class Time: MWF 8:10 – 9:10 pm  
Text: Organic Chemistry (Wade, 9th Ed.)  
Prerequisites: CHE 117: Principles of Chemistry  
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Lab Time: W 2:00 – 5:00 pm

Course Overview

Organic chemistry, or the chemistry of carbon, is the examination of the fundamental chemical reactions that control life. Since its inception as a science in the 1820s when Friedrich Wöhler synthesized urine… uh, I mean urea… organic chemistry has exploded to encompass thousands of well-known reactions. This knowledge has provided us with many of today’s conveniences; everything from the medicine you might take to focus in my boring lecture to the comfy, foam dorm mattress where you pleasantly dream about exams. Therefore, whether you want to be a doctor, pharmacist, engineer, or chemist (gasp), you will require a basic knowledge of organic chemistry to have a successful career… or at least make it through biochemistry.

This course is the first part of a yearlong curriculum that will aim to provide you with only a small view of the fundamentals of organic reactions. By the end of this course you should be able to:

- Understand how the fundamental properties of atoms, such as electronegativity, affect their reactivity
- Speak the basic vernacular of chemistry including the ability to name novel molecules
- Visualize structures in three dimensional space and how their conformation affects reactions
- Predict the reactivity modes and transformations of several simple organic functional groups
- Design multi-step syntheses to construct molecules from simpler building blocks
- Make connections between material to answer complex and multi-step problems

Grading

10% In-Class Quizzes and Homework Assignments  
20% Laboratory Grade  
50% Exams (4 Tests)  
20% Final

Laboratory Grade: See the syllabus provided for the Lab.

Quizzes: Quizzes given at the start of classes will focus on the main points summarized in the assigned reading. Missed quizzes will count as a zero, but I understand absences are sometimes unavoidable. Therefore, the two lowest quiz scores will be dropped from your grades to allow for illness, unforeseen scheduling conflicts, or waking up on the wrong side of the bed. If you have an extended absence that may cause you to miss more than two quizzes, please notify me so that I may accommodate you.

Homework Assignments: I felt the book sometimes does not provide you with adequate practice for the subjects we will be covering. Therefore, you will see several “Worksheets” marked in the suggested problems below (see schedule). These worksheets are primarily for you to practice, so, if they are completed with a good faith effort, you will receive full credit upon turning them in. I also encourage you to work together on problems as several of them will require critical thinking to solve (two brains are better than one, yada yada).

Tests: Tests will examine your deeper comprehension of the covered material. These exams may include multiple choice, short answer, mechanism schemes, and multi-step synthesis. These will be administered roughly once a month on the days indicated. Write the exam days down in your planners in super-permanent ink.

Final: This is a comprehensive final and will be structured as a longer test.
Additional Resources

**Online Resources:** I will post additional resource material, such as mechanism videos, molecular models, and practice problems, on the course Desire2Learn website for you to review. I encourage all of you to suggest problems that you are struggling with so that I may tailor these resources for class needs.

**Office Hours:** I am a firm believer in extensive office hours to help you succeed. I will provide the normally scheduled times for the office hours at the start of the semester. However, I am also available for office hours by email appointment provided you allow for several days notice. Please bring specific questions or concerns to make these sessions more productive. Also, try to come as small groups of students (3-4), so that I may help as many of you at once as possible. As Dr. Smith and Dr. Wilson have their own classes, please be considerate of their students’ time and do not use their office hours for yourself. If you cannot make my office hours, please email me so we can work out a time.

**Study Groups:** Science should exist as a community of collaborative learners. Students who work together can boost their peers’ learning as well as their own understanding of the course material by helping others. For students who are interested in studying together, I will provide online polls to help you determine times that several of you may meet to study for exams.

**Tips to Succeed**

*Read, read, READ:* Course quizzes will use main topics contained in the assigned reading, so you must read prior to class to do well on these assessments. I would also encourage you to take notes as you read, since I will allow these notes to be used during quizzes. Additionally, these sections will prepare you for the day’s lecture so that you can absorb more of the information and gain a deeper understanding of the material.

*Join a study group:* As I have outlined above, I will help you find other students to study with. Making friends while aiding each other in learning will make the class more enjoyable and improve your collaboration skills.

*Practice and test your knowledge several times a week using the suggested problems:* Organic chemistry is a difficult subject, because of the pure volume of material. Therefore, cramming will not help you on tests. Set aside time each week (~3-4 hours) to practice and stay ahead of the material. **Be sure to do at least the suggested problems I have listed at the end of the chapter and the problems directly in the suggested reading sections.** If you do this, you will be able to quickly adapt to new material and have to devote less time (and loss of sleep) to studying during test week.

*Utilize the online resources and office hours:* During your study time each week, be sure to check out the online material for additional videos or problems. These will give you more practice and help you review material you may have missed in class. Also, do not hesitate to come to office hours with specific question or concepts you have struggled with.

*Use on campus resources to help you study:* The school’s Learning and Writing Services office offers resources for students to help them study. Please see their link below:

1. Learning and Writing Services, Westminster College
   https://www.westminster.edu/academics/learning-writing-services.cfm

**Attendance and Missed Assignment Policy**

Class attendance is not technically required, but I will often have quizzes at the start of class to test your basic comprehension of the assigned reading material. I will not announce these quizzes ahead of time, so I encourage you to attend class to ensure you can take these. A missed quiz or exam will be marked as 0. However, if you have a documented illness, family emergency, or school sanctioned event that causes you to miss a quiz or test, I will allow you to take a make up one within 48 hours of the assessment or after returning from your illness. Please, let me
know \textit{at least} a week ahead if you have a planned absence (conference, athletic contest, etc.), so that I can make arrangements for you to take the quiz or test. Lab attendance is mandatory, and the full lab attendance policy is detailed on the Lab syllabus.
CHEM 261 Lecture Schedule

Aug. 28: Syllabus and General Chemistry Game Day

Aug 30: Atomic Structure Review
  Suggested Reading: Section 1-1 to 1-7 (pages 1 to 13)
  Suggested Problems: 27, 29-32, 34

Sept. 1: Drawing Organic Structures, Resonance, and Arrows
  Suggested Reading: Section 1-8 to 1-11 (pages 13-26)
  Suggested Problems: 37-43, 46

Sept. 4: VSEPR, Orbital Hybridization, and Bond Rotation
  Suggested Reading: Section 1-12 to 1-18 (pages 27 to 44)
  Suggested Problems: 50-55

Sept. 6: Isomers, Intermolecular Forces, Acid-Base Equilibrium
  Suggested Reading: Section 1-19 (pages 44 to 46); Section 2-1 to 2-7 (pages 55 to 76)
  Suggested Problems: (1) 58, 59; (2) 29-35, 39, 42, 43; Acid/Base Worksheet (Pt. 1)

Sept. 8: Structural Effects on pKa, Nucleophiles/Electrophiles (Lewis Acid/Base), Drawing a Mechanism
  Suggested Reading: Section 2-8 to 2-14 (pages 76 to 90); Drawing a Mechanism Handout
  Suggested Problems: 36-38, 40, 45-53; Acid/Base Worksheet (Pt. 2)

Sept. 11: Functional Groups and Alkane Nomenclature (Naming)
  Suggested Reading: Section 2-15 to 2-17 (page 90 to 98); Section 3-2 to 3-3 (pages 108 to 117); Summary of Organic Nomenclature Appendix 5 (page 1322)
  Suggested Problems: Naming Handout (Pt. 1); Ch. 2: 55-57; Ch. 3: 39a-c, and 41a-d

Sept. 13: More Naming: Cycloalkanes, Alkyl Halides, Alkenes, and Alcohols
  Suggested Reading: Section 3-10 to 3-11 (pages 129 to 132); Section 6-2 (pages 248 to 250); Section 10-3 (pages 460 to 466); IUPAC rules handout
  Suggested Problems: Naming Handout (Pt. 2); Ch. 3: 36, 37, 39 d-h, Ch. 6: 31, 32, Ch. 10: 30a-c

Sept. 15: Exam 1

Sept. 18: Conformations: Newman Projections and their Energy Diagrams
  Suggested Reading: Section 3-7 to 3-9 (pages 122 to 129)
  Suggested Problems: 34f, 40, 44, 48-50

Sept. 20: Cycloalkanes Stability and Introduction to Cyclohexane Conformations
  Suggested Reading: Section 3-10 to 3-14 (pages 129 to 142)

Sept. 22: Cyclohexane Conformations and Bicyclic Molecules
  Suggested Reading: Section 3-15 to 3-16 (142 to 148)
  Suggested Problems: 39 d-h, 46, 47, 51

Sept. 25: Introduction to Stereochemistry: Chirality and R&S rotation
  Suggested Reading: Section 5-1 to 5-7 (pages 201 to 220)
  Suggested Problems: 25-27, 30, 31

Sept. 27: Diastereomers and Resolution
  Suggested Reading: Section 5-8 to 5-16 (pages 221 to 241)
  Suggested Problems: 30a-c, 31b-c, 37, 38, 41

Sept. 29: Introduction to NMR: Theory, chemical shifts, integration, and splitting
**Suggested Reading:** 13-1 to 13-8C (focus primarily on 13-4 to 13-8) (pages 607-630)

**Suggested Problems:** 33-36, 39-40, 44, 46; NMR Worksheet (Pt. 1)

**Oct. 2:** Introduction to NMR: Coupling constants, complex splitting, and C-13 NMR

**Suggested Reading:** 13-8D to 13-10 (631 to 639) and 13-12 to 13-13 (648 to 658)

**Suggested Problems:** NMR Worksheet (Pt. 2)

**Oct. 4:** Reaction Selectivity Based on Intermediate Stability

**Suggested Reading:** Sections 4-4 to 4-11 (pages 161-174); Section 4-14 (182-183); Sections 4-16 (pages 187 to 194)

**Suggested Problems:** 34-40, 42, 45

**Oct. 6:** Review Day and Catch-up

**Oct. 9:** **Exam 2**

**Oct. 11:** Nucleophilic Substitution: Nucleophile/Leaving Group Strengths and Mechanistic Variations

**Suggested Reading:** Sections 6-7 to 6-13 (pages 260-279)

**Suggested Problems:** 33-42, 46

**Oct. 13:** Nucleophilic Substitution: Rearrangements & Stereochemistry

**Suggested Reading:** Sections 6-14 to 6-16 (pages 279 to 287)

**Suggested Problems:** 43-45, 50, 52, 54, 56

**Oct. 16:** Nucleophilic Substitution: Substitution with Alcohols

**Suggested Reading:** Sections 11-5 (pages 515-518), Section 11-6 to 11-9 (pages 519-526), Section 11-11A (pages 534-536), & 11-14 (pages 540-542)

**Suggested Problems:** 39(a-b,i-j, m-n), 46-47, 49, 58, Nucleophilic Substitution Practice Sheet

**Oct. 18:** Pi Bonds: Structure, Conjugation, and Stability

**Suggested Reading:** Sections 7-1 to 7-8 (pages 296-318); Sections 9-1 to 9-2 (pages 428-430); Section 9-5 to 9-6 (pages 433-435)

**Suggested Problems:** Ch 7: 40-43, 47, 48, 70. Ch. 9: 26, 36

**Oct. 20:** Pi Bonds: Elimination Reactions

**Suggested Reading:** Sections 7-9 to 7-15 (pages 318-334); 9-8 (pages 439-440)

**Suggested Problems:** Ch 7: 49-56, 58

**Oct. 25:** Pi Bonds: Comparing Mechanisms and Hoffman vs. Zaitsev Products

**Suggested Reading:** Sections 7-16 to 7-18 (pages 334 to 344); Section 19-14 (page 967-970)

**Suggested Problems:** Ch. 7. 60, 61-65, 71-74; Ch. 19. 38(e-f)

**Oct. 27:** Pi Bonds: Electrophilic Addition to Alkenes/Alkynes, Tautomerization

**Suggested Reading:** Sections 8-1 to 8-4 (pages 359-372); Sections 9-9E to 9-9F (pages 445-448)

**Suggested Problems:** *NOTE* The textbook mixes many reactions from future sections together in each problem. If you want to work ahead, see Day 27 for suggested problems, but do not feel intimidated if you are not familiar with each reaction yet. However, do work through each practice problem embedded in the suggested reading.

**Oct. 30:** Pi Bonds: Hodge Podge of Reactions (Hydrogenation, Halogenation, Carbenes, and Epoxides)

**Suggested Reading:** Sections 8-5 to 8-12 (pages 372 to 395); Sections 9-9 (pages 441-450)

**Suggested Problems:** See Day 27

**Nov. 1:** Pi Bonds: Oxidation, Metathesis, and Wrap-Up
Nov. 3: Planning a Synthesis
   *Suggested Reading:* Problem Solving Strategy—Organic Synthesis (pages 410–412)
   *Suggested Problems:* Retrosynthesis Sheet

Nov. 6: Catch-up and Review Day

Nov. 8: **Exam 3**

Nov. 10: Carbonyl Compounds: General Features and Reactivity Trends
   *Suggested Reading:* *NOTE* A lot of reading/sections here, but focus primarily on properties in Chapters 18, 20, and 21. Sections 18-1 to 18-4 (pages 876–882); Section 20-1 to 20-5 (pages 1002–1013); Section 21-1 to 21-3 (pages 1043–1053)

Nov. 13: Carbonyl Compounds: Oxidation and Reduction
   *Suggested Reading:* Sections 11-1 to 11-3 (pages 505–513); Sections 10-11 (pages 489–494); Sections 18-19 to 18-20 (pages 922 to 925).

Nov. 15: Carbonyl Compounds: Grignard and Organometallic Reactions
   *Suggested Reading:* Sections 10-8 to 10-9 (475–481); Sections 18-7 to 18-11 (pages 889–902)
   *Suggested Problems:* Ch. 10: 36(a–f), 39; Carbonyl Compounds Sheet (Pt. 1)

Nov. 17: Carbonyl Compounds: Condensations with Nitrogen and their Transformations
   *Suggested Reading:* Section 18-12 to 18-15 (pages 902–911)

Nov. 20: Carbonyl Compounds: More Nucleophilic Additions and Protecting Groups
   *Suggested Reading:* Section 18-16 to 18-18 (pages 911 to 921)
   *Suggested Problems:* Carbonyl Compounds Sheet (Pt. 2)

Nov. 27: Carbonyl Compounds: Carbonyls with Good Leaving Groups
   *Suggested Reading:* Sections 20-8 to 20-13 (pages 1019–1033)
   *Suggested Problems:* 35–37, 39, 44, 48

Nov. 29: Carbonyl Compounds: Acyl Substitution and Fischer Esterification
   *Suggested Reading:* Section 21-5 to 21-9 (pages 1060–1082)
   *Suggested Problems:* Ch. 21: 47-50, 57-59

Dec. 1: Carbonyl Compounds: Summary and Wrap-up
   *Suggested Reading:* Sections 21-10 to 21-15 (pages 1083–1097)

Dec. 4: Radical Halogenation
   *Suggested Reading:* Sections 4-1 to 4-3 (pages 155–161); Sections 4-12 to 4-13 (pages 172–181); Section 4-15 (pages 186–187)
   *Suggested Problems:* 44, 46-51, 55-58

Dec. 6: **Exam 4**

Dec. 8: Final Exam Review

Dec. 12: **FINAL Section 1: 11:30 – 2:00; Section 3: 8:00-10:30 am**

Dec. 13: Final Grades Online and Christmas Break (You don’t have to go home but you can’t stay here).
Homework Assignments Schedule

The following practice homework sheets are due on the indicated days. I will post them a week prior to their due date on Desire2Learn. These assignments are for you to practice. Therefore, if you make a good faith effort to answer them completely and thoughtfully, you will receive credit for them.

1. Acid-Base Worksheet (Pt. 1)          Due September 8th
2. Acid-Base Worksheet (Pt. 2)          Due September 11th
3. Naming Worksheet (Pt. 1)             Due September 13th
4. Naming Worksheet (Pt. 2)             Due September 15th
5. NMR Worksheet (Pt. 1)                Due October 2nd
6. NMR Worksheet (Pt. 2)                Due October 4th
7. Nucleophilic Substitution Worksheet  Due October 18th
8. Retrosynthesis Worksheet             Due November 6th
9. Carbonyl Worksheet (Pt. 1)           Due November 17th
10. Carbonyl Worksheet (Pt. 2)          Due November 27th