CHM 303 – Organic Chemistry Theory I Course Syllabus

Student Learning Objectives

The main goal of this first semester of this yearlong course of study is to provide you with an **in-depth** understanding of the basic concepts of organic chemistry. The naming, structure, properties, and reactions of several classes of organic molecules will be studied. Topics will be organized and presented on the basis of organic functional group families, and this organizational scheme will continue into the second semester of the course (CHM 304). Special emphasis will be placed on **predicting physical properties** of organic molecules, **understanding chemical reactivity** of various functional groups, and **proposing rational electron pushing reaction mechanisms**.

Professor

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Office phone: (608) 785-8287

Office Hours: My door is **always** open to CHM 303 students. Feel free to drop by anytime to talk or schedule appointments to ensure I will be around. Especially good times to catch me in my office this semester will be Mondays 9:00 AM - 10:30 AM and Tuesdays 11:00 AM - 12:30 PM.

Class

Meets M-W-F 7:45-8:40 AM. Room 100 Cowley Hall. Attendance is expected, however if you have to be absent from lecture please make arrangements to get the materials from a classmate so that you don't fall behind. Visitors are welcome and seating is on a first-come-first-served basis.

Textbooks

Carey, Francis A., and Giuliano, Robert M., *Organic Chemistry*. 9th edition. New York: The McGraw-Hill Companies, Inc., © 2014.

* The accompanying solutions manual is available from textbook rental and is **highly** recommended.

Molecular Models

These may be purchased from the bookstore or online. Models will assist you in visualizing the three-dimensional structure of organic molecules. They will be especially useful when studying stereochemistry (Chapter 7) and related stereochemical topics. You may also use a model kit on the quizzes and exams if you wish.

Quizzes, Examinations, & Grading

All graded quizzes and exams will be returned during class or can be picked up at my office. Exam keys will be posted for ~1 week following each exam in the display case near room 402 Cowley Hall. Also note the following:

- Cheating. Will not be tolerated. You are expected to maintain a high level of academic honesty and integrity, and any indication that these standards are not being met will be confronted. Plagiarism, cheating on exams, and copying the work of fellow students will invoke severe penalties and can lead to your dismissal from the University. For complete details on UW-L's policy on student conduct, please refer to the following website: http://www.uwlax.edu/StudentLife/academic_misconduct.htm
- Take-Home Quizzes (4 x 25 points). Four, take-home quizzes worth 25 points each will be given throughout the semester that will highlight the most important concepts from each unit. These will help clarify the most likely topics to show up on subsequent exams and help to determine which topics require additional studying.
- Exams (4 x 100 points). Four, 55-minute exams worth 100 points each will be given during class time. If an exam has to be missed, arrangements must be made with me ahead of time to schedule a make-up exam. An absence without prior notice will result in a score of o points on that exam.
- * Final Exam (150 points). Comprehensive final exam covering various aspects of chapters 1-13.

- Homework. You must work and understand the assigned in-text problems along with any additional problem sets posted on D2L! These will not be collected or graded, but should be taken very seriously as your main study guide. The assigned problems reflect the concepts that will be covered on exams. Solutions to all chapter problems are explained in the solutions manual and solutions to the additional problem sets will be posted on D2L. Also, the additional "self-tests" found in the solutions manual are good practice exams to test your knowledge. TAKE HOME MESSAGE: Practice, practice, practice!
- * **Final Grading Scheme:** The course has a total of 650 points possible and your final grade will be assigned based on these percentage breakdowns:

 $\mathbf{A} = 100-90\% || \mathbf{AB} = 89-85\% || \mathbf{B} = 84-78\% || \mathbf{BC} = 77-70\% || \mathbf{C} = 69-60\% || \mathbf{D} = 59-51\% || \mathbf{F} = <51\%$

Course Tutor

At least one senior-level chemistry major will be made available as a class tutor to help you individually or in small groups. The Department of Chemistry bears all costs of this tutoring. You are encouraged to take advantage of this free service if you feel that it will improve your understanding of the course topics. The tutor(s) will be available in the **Math** and Science Learning Center, Murphy Library.

Help Sessions

Prior to the first exam, I will begin hosting *optional* weekly help sessions to informally answer any of your questions and discuss course material. These will be tentatively scheduled for **3:30 PM on Wednesdays** and the first help session date will be announced in class. The assigned homework problems will typically serve as a basis for our discussions along with any other issues or questions you may have. If you cannot make these sessions, *please feel free to meet with me in my office at any time!* Always get help early if you need it!

Study Groups

Working within a group has been shown to **greatly** enhance most students' learning and understanding of organic chemistry. I would recommend that you form a study group of 3-5 classmates early in the semester and meet at least once or twice per week to review class concepts together and go over the suggested problems from each chapter. Practice expressing the concepts covered in class to one another verbally and on the board or paper to reinforce your understanding and communication skills.

Students with disabilities

Any student with a documented disability (e.g., physical, learning, psychiatric, vision, hearing, etc.) who needs to arrange reasonable accommodations must contact the instructor and the *Disability Resource Services Office* (165 **Murphy Library**, 785-6900) at the beginning of the semester. Students who are currently using the Disability Resource Services Office will have a copy of a contract that verifies they are qualified students with disabilities who have documentation on file in the Disability Resource Services Office. It is the student's responsibility to communicate their needs with the instructor in a timely manner.

Day	Date	Carey Ch.	Lecture Topics
1	1/27	Intro	Introduction to the course. Fill out notecards.
2	1/29	1.1-1.6	Review from Gen. Chem.: atoms, electrons, bonding, charge.
3	1/31	1.7-1.8, 1.10-1.16	Hydrocarbon structure, isomers, resonance, acids/bases, curved arrows.
4	2/3	2.1-2.10	Molecular orbitals & hybridization.
5	2/5	2.11-2.18, 2.20-2.22	Alkanes: naming, physical properties, & oxidation states.
6	2/7	3.1-3.8	Conformational analysis of alkanes and cycloalkanes. Chair conformations.
7	2/10	3.9-3.12	Chair interconversion, substituted cyclohexanes.
8	2/12	7.1-7.6	Chirality: Enantiomers, chirality, optical activity, R/S.
9	2/14	7.7-7.9	Fischer projections, enantiomer properties, chirality without chiral centers.
10	2/17	7.10-7.14	Diastereomers, meso compounds. < End E1 material>
11	2/19	4.1-4.8	Alcohols and alkyl halides: naming, bonding, properties, and preparation.
12	2/21	CH 1, 2, 3, 7	EXAM #1 - Basic Concepts, Alkanes, and Chirality
13	2/24	4.9-4.17	Carbocation stability, halogenation, free radicals.
14	2/26	5.1-5.6	Alkenes: naming, bonding, stereoisomers, & physical properties.
15	2/28	5.8-5.16, 5.18	Alkene Formation: Elimination reactions: E1 and E2.
16	3/3	6.1-6.6	Alkene addition reactions (H ₂ , H-X, H ₃ O ⁺), Markovnikov's rule.
17	3/5	6.7, p. 258, 6.8-6.9	Le Chatelier, Oxymercuration-Reduction, Hydroboration-Oxidation.
18	3/7	6.10-6.11, p. 622, 15.11	X ₂ , X ₂ /H ₂ O, X ₂ /ROH, Epoxidation, Dihydroxylation/Diol-Cleavage
19	3/10	6.12-6.15	Ozonolysis, H-X/ROOR, Retrosynthetic Analysis. <end e2="" material=""></end>
20	3/12	9.1-9.6	Alkynes: naming, properties, acidity, alkylation.
21	3/14	CH 4, 5, 6	EXAM #2 – Alcohols and Alkenes.
	3/17	NO CLASS SPRING	BREAK
	3/19	NO CLASS SPRING	BREAK
	3/21	NO CLASS SPRING	BREAK
22	3/24	9.7-9.10, 9.15	Generation of alkynes, alkyne reductions, use in synthesis.
23	3/26	9.11-9.14	Alkyne addition reactions, tautomerization.
24	3/28	13.20-13.24	Spectroscopy: IR, UV-Vis, MS, and Unsaturation #. (Last Day To Withdraw)
25	3/31	13.3-13.12, 13.14-13.16	Spectroscopy: ¹ H-NMR and ¹³ C-NMR theory.
26	4/2		NMR Problems.
27	4/4		NMR Problems.
28	4/7	8.1-8.5	Nucleophilic substitution: S _N 2.
29	4/9	8.1-8.5	Nucleophilic substitution: S _N 2.
30	4/11	8.6-8.9	Nucleophilic substitution: S _{N1} .
31	4/14	8.10-8.12	S _N 2/S _N 1/E2/E1, sulfonate esters, synthesis. <end e3="" material=""></end>
32	4/16	10.1-10.4	Allylic systems: Conjugation, resonance, and subsequent reactivity.
33	4/18	CH 9, 13, 8	EXAM #3 – Alkynes, Spectroscopy, S _N 2, S _N 1, E2, and E1.
34	4/21	10.5-10.11	Dienes: Stability and addition reactions.
35	4/23	10.12-10.14	The Diels-Alder reaction.
36	4/25	11.1-11.7	Arenes and aromaticity: Properties, derivatives, and naming.
37	4/28	11.8-11.12, 11.15	Benzylic reactivity, Birch reductions.
38	4/30	11.17-11.20	Aromaticity and Huckel's rule.
39	5/2	12.1-12.8	Electrophilic aromatic substitution (EAS) reactions.
40	5/5	12.9-12.21	Effect of substituents on EAS reactions, S _N Ar reactions. <end e4="" material=""></end>
41	5/7		Review Day For Exam 4 / Final Exam
42	5/9	CH 10, 11, 12	EXAM #4 – Allylic reactivity, Diels-Alder, aromaticity, and EAS
			STUDY DAY
			COMPRESENTATE FINAL ACCORANT ACCORDING MANAGE

CHM 303 – Organic Chemistry Theory I: Chapter Coverage & Daily Lecture Topics

Recommended End-Of-Chapter Problems

In addition to understanding how to do these assigned problems, you should also practice your O-Chem skills by working through the problems within the text of each chapter as you complete your readings.

CHAPTER 1: Structure Determines Properties **DO PROBLEMS:** 40, 42, 45, 46, 52, 57, 58, 60, 61, 62, 64, 67, 68, 69, 70, 71, 72, 73

CHAPTER 2: Alkanes and Cycloalkanes: Introduction to Hydrocarbons DO PROBLEMS: 22, 24, 28, 29(not a,b), 33, 35, 42, 43, 44, 45, 46, 47, 48

CHAPTER 3: Alkanes and Cycloalkanes: Conformations and cis/trans Stereoisomers DO PROBLEMS: 20, 21, 23, 24, 25, 26, 27, 29, 32, 33, 34, 37, 41, 42, 43, 44, 45, 46

CHAPTER 7: Chirality

DO PROBLEMS: 33, 35, 36, 37, 38, 39, 40, 42, 44, 47, 50, 54

EXAM 1: Chapters 1, 2, 3, 7 (100 points)

CHAPTER 4: Alcohols and Alkyl Halides: Introduction to Reaction Mechanisms DO PROBLEMS: 24, 25, 30, 33, 35, 36, 37, 38, 39, 40(not d), 41, 45, 50, 51, 52, 53, 54, 55, 56

CHAPTER 5: Structure and Preparation of Alkenes: Elimination Reactions DO PROBLEMS: 29, 33, 37, 38, 39, 40, 41, 42, 43, 47, 48, 51, 54, 55

CHAPTER 6: Addition Reactions of Alkenes

DO PROBLEMS: 27, 30, 32, 34, 36, 37, 39, 40, 41 (not j,k), 44, 47, 48, 49, 51, 54, 57, 58, 64, 65, 67, 68

EXAM 2: Chapters 4, 5, 6 (100 points)

CHAPTER 9: Alkynes

DO PROBLEMS: 18, 21, 22, 23, 25, 26, 29, 31, 33, 34, 35, 37, 38, 39

CHAPTER 13: Spectroscopy DO PROBLEMS: 32, 33, 38, 39, 41, 44, 45, 46, 51, 52

CHAPTER 8: Nucleophilic Substitution

DO PROBLEMS: 21, 22, 23, 26, 31, 32, 33, 34(not d,h), 35, 38, 39

EXAM 3: Chapters 9, 13, 8 (100 points)

CHAPTER 10: Conjugation in Alkadienes and Allylic Systems DO PROBLEMS: 25, 26, 28, 29, 31, 32, 35, 36, 38, 40, 41, 42, 43, 47, 49, 53

CHAPTER 11: Arenes and Aromaticity **DO PROBLEMS:** 34, 40, 41, 44, 45, 47, 48, 50, 51, 55, 56, 58

CHAPTER 12: Electrophilic Aromatic Substitution DO PROBLEMS: 33, 34(a-j & l-m), 36, 38, 39 (a-f), 40, 46, 47, 50, 53

EXAM 4: Chapters 10, 11, 12 (100 points)

FINAL EXAM: Comprehensive. Chapters 1-13 (150 points)