Chem. 130 Elementary Organic Chemistry

Spring 2019

Schedule number: 20662

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COURSE INFORMATION

Class Days: MWF
Class Times: 11:00-11:50
Class Location: SHW-011

Office Hours: MW 9:00-10:00 and by appointment
Office Hours Location: CSL 204

Course Overview

Chem 130 covers the fundamental organic chemistry needed for fields related to health and the environment. Chem 130 will prepare students for Chem 160 (biochemistry). A majority of the course material will focus on applications of organic chemistry geared towards biochemistry and important connections found in our world. Organic chemistry (Chem 130) differs from general chemistry in that it focuses on the top row of elements in the periodic table and the halogens (C, H, N, O, F, Cl, Br, I). Since we are living in a 3D-world, the 3-dimensional shape of molecules is particularly important. Chem 130 will also cover fundamental organic transformations and how they are applied to everyday life and biochemistry.

Enrollment Information

Prerequisites: Chem 100. (Note: Other chemistry courses may qualify as a prerequisite. I will consider these and you should see the instructor as soon as possible.)

Course Materials

Required Text: Introduction to organic chemistry by William H Brown and Thomas Poon (Wiley), 6th Edition.

Highly Recommended Text: Students Solutions Manual to Accompany Introduction to Organic Chemistry by Brown, Poon, and Erickson (Wiley), 6th Edition.

Optional Model Kit: Prentice Hall Molecular Modeling Kit for Organic Chemistry (or comparable)

Course website: http://www.chemistry.sdsu.edu/courses/CHEM130/

Electronic Homework: Wiley Plus. The best way to learn organic chemistry is through doing plenty of problem solving. Roughly 18% of your course grade (150 points scaled based on percentage of HW points received) will be from the electronic homework. We will be using the online homework that is bundled with the textbook via Wiley plus. There will be approximately 1 hour of electronic homework per chapter, which is due a few days after the last lecture covering the specific chapter. It is very important that you keep up with the homework and do not fall behind. Do not wait until the last minute with submission electronically. You will be informed about the deadline well in advance so no request for extensions of due date and time will be granted.

Lecture Notes: Powerpoint slides will be posted as soon as possible on the Chem 130 website. Please note: Blackboard will only be used for posting of grades and email. The notes cover the major topics in the course, **and are not a replacement for coming to class and reading the book!!**

Assigned text Problems: In the end of the syllabus there are a list highly recommended problems from each chapter found in the book. These problems are similar (not identical) to the problems you will face on the exams. The key take-home from organic chemistry is the understanding of the topics, thus you should never memorize but instead understand and apply yourself. If you try to memorize concepts it's a guarantee for an "F" in the course. WORK THE PROBLEMS !!

Course Structure and Conduct

This course will be presented in a traditional lecture 'chalk talk' format. It is imperative you start the post-chapter homework as chapters are covered in lecture. It is also important that you read the text and work the pre-lecture homework before and after lecture so that you are familiar with the material as it is presented. The best advice for this class is to be proactive. Start the homework early, go to my office hours for help, advice or if you feel you are falling behind, and read ahead in the book and notes.

Course Assessment and Grading

Exams: There will be three exams during lecture hour (150 points each) and one final (250 points).
Dates: Exam 1 (chap 1-3): Feb 15. Exam 2 (chap 4-7): March 15. Exam 3 (chapter 8-10): April 12.
Final Exam: Monday May 12, 10:30-12:30 am
There will be three 1 hour midterm exams during the semester, **each worth 150 points**. Each exam consist of 20 multiple choice questions (40%) and 6-8 short answers type questions (60%). The 2 hour final exam is cumulative and is worth **250 points**. If beneficial your final exam score can replace your lowest exam score. **Thus, there will be no make-up exams.** If you miss an exam, for *any reason,* your final exam percentage will automatically replace it. The final exam is not optional and cannot be dropped. **There will be no quizzes.** The online homework is worth **150 points.** Your final grade will be based on a maximum of **850 points**, distributed as follows: 3 exams (150 points each), 1 Final Exam (250 points), Online Homework (150 points),

Letter Grade Assignment: Depending on class performance the Exams may be curved. If necessary the class average will be curved to a 72 % (the lowest B-). Please note that the grade distribution below is just a guide, and may change according to class performance.

90%	A	66%	C
86%	A–	62%	C–
82%	B+	58%	D+
78%	B	54%	D
72%	B–	50%	D–
70%	C+	<50%	F

Student Learning Outcomes (broken down by chapter). The included schedule below is tentative and subject to change:

Chapter 1-Covalent bonding and Shapes of molecules

1) Describe the electronic structure of atoms.
2) Use the Lewis model of bonding to describe the nature of a bond between 2 atoms
3) Use VSPER theory to predict the shape of simple organic molecules
4) Use the concepts in SLO 1.1-1.3 to identify polar and non-polar molecules
5) Understand the concept of 'resonance' and apply it to a better understanding of how a molecule truly exists (as compared to the Lewis Dot Structure)
6) Gain a basic understanding of hybridization and the orbital overlap model of bonding.
7) Be able to identify whether an atom is sp, sp^2, or sp^3
8) Identify common functional groups

Chapter 2-Acids and Bases:

1) Identify Arrhenius, Bronsted-Lowry, and Lewis Acids and Bases
2) Understand the relationship between pK_a and acidity, and how pK_a is calculated.
3) Using pK_a data, predict the equilibrium of an Acid-Base reaction.
4) Identify conjugate acid-base pairs for Bronsted-Lowry acids and bases.
5) Relate position in periodic table to acidity.
7) Draw relationships between acidity and molecular structure

Chapter 3-Alkanes and cycloalkanes:
1) Describe what an alkane is
2) Identify constitutional isomers of an alkane.
3) Name simple alkanes according to IUPAC Rules
4) Describe the different conformations of alkanes and cycloalkanes. Relate conformation to energy level
5) Draw the condensed and line-angle structural formulas and give the names for the cis-trans isomers of alkenes.
6) Understand the molecular properties and trends that lead to varying physical properties of alkanes.
7) Explain where many alkanes come from.

Chapter 4-Alkenes and Alkynes:
1) Describe what alkenes and alkynes are. Describe their structures, shapes, and physical properties.
2) Name simple alkenes and alkynes according to IUPAC rules.

Chapter 5-Reactions of alkenes and alkynes:
1) Understand the concept of a reaction mechanism and how we denote electron movement via 'arrow pushing'
2) Understand the basic idea of electrophilic addition reactions to alkenes and alkynes.
3) Understand what a carbocation is and the factors that lead to carbocation stability trends.
4) Describe a Carbocation rearrangement.
5) Understand the basic idea behind the reduction of alkenes to alkynes, and alkynes to alkenes.

Chapter 6-Chirality and the handedness of molecules:
1) Understand the difference between isomers, stereoisomers, and enantiomers (non superimposable mirror images). Draw a connection between molecular chirality and handedness.
2) Know what a stereocenter is, and how we designate it's conformation using 'R and S' nomenclature.
3) Describe how we deal with molecules with multiple stereocenters.
4) Describe the differences in physical properties between stereoisomers.
5) Understand the real world consequences of chirality (i.e. thalidomide).

Chapter 7-Haloalkanes:
1) Name simple halo-alkanes using IUPAC rules and predict the physical properties of them using concepts previously learned in class.
2) Describe the products and mechanism of nucleophilic aliphatic substitution reactions (S_N1 and S_N2)
3) Understand the mechanistic differences between S_N1 and S_N2 reactions as well as the factors that will lead to each reaction.
4) Predict products and understand mechanism of Elimination reactions (E1 and E2)
5) Understand the mechanistic differences between E1 and E2 reactions as well as the factors that will lead to each reaction.

Chapter 8- Alcohols, ethers, and thiols:
1) Name simple alcohols, ethers and thiols using IUPAC rules and understand the characteristic physical properties of each.
2) Understand the reactivity of alcohols, ethers and thiols.
3) Understand the basic properties of an epoxide (special cyclic ether).

Chapter 9- Benzene and its derivatives:
1) Understand the concept of aromaticity and be able to predict if a compound is aromatic.
2) Be able to name simple aromatics using IUPAC rules and predict their physical properties.
3) Understand the characteristic reactions of aromatics, particularly electrophilic aromatic substitution.

Chapter 10-Amines:
1) Understand the chemical and physical properties of amines and how to name simple amines using IUPAC Nomenclature
2) Understand the characteristic reactivity of amines (basic, generally good nucleophiles).

Chapter 12-Aldehydes and Ketones:
1) Understand the chemical and physical properties of aldehydes and ketones and how to name simple aldehydes and ketones using IUPAC Nomenclature.
2) Understand the characteristic reactivity of ketones and aldehydes (electrophiles at the C-2 Carbon).
3) Describe the difference between adding a strong nucleophile (Grignard reagent) and a weak nucleophile (water) to a aldehyde and ketone.
4) Understand what acetals and ketals are and how they relate to carbohydrates.

Chapter 13-Carboxylic acids:
1) Understand the chemical and physical properties carboxylic acids and how to name them using IUPAC Nomenclature.
2) Understand the characteristic reactivity of carboxylic acids (The OH is acidic, the carbonyl carbon is somewhat electrophilic.

Chapter 14-Functional derivatives of carboxylic acids (through 14.6):
1) Know the common derivatives of carboxylic acids and how to name them.
2) Understand the characteristic reactions of carbonyl derivatives (electrophiles at Carbonyl carbon)

Chapter 18-Amino acids and proteins:
1) Understand what an amino acid is and how they come together to form a protein (via the amide bond)
2) Be able to identify basic secondary structure features of proteins and that H-bonding largely acts as the glue that holds these features together.

Students with Disabilities

If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to contact Student Disability Services at (619) 594-6473. To avoid any delay in the receipt of your accommodations, you should contact Student Disability Services as soon as possible. Please note that accommodations are not retroactive, and that accommodations based upon disability cannot be provided until you have presented your instructor with an accommodation letter from Student Disability Services. Your cooperation is appreciated.

Academic Honesty

The University adheres to a strict policy regarding cheating and plagiarism. These activities will not be tolerated in this class. Become familiar with the policy (http://www.sa.sdsu.edu/srr/conduct1.html). Any cheating or plagiarism will result in failing this class and a disciplinary review by Student Affairs.

Examples of Plagiarism include but are not limited to:

- Using sources verbatim or paraphrasing without giving proper attribution (this can include phrases, sentences, paragraphs and/or pages of work)
- Copying and pasting work from an online or offline source directly and calling it your own
- Using information you find from an online or offline source without giving the author credit
- Replacing words or phrases from another source and inserting your own words or phrases
- Submitting a piece of work you did for one class to another class

If you have questions on what is plagiarism, please consult the policy (http://www.sa.sdsu.edu/srr/conduct1.html) and this helpful guide from the Library:(http://infodome.sdsu.edu/infolit/exploratorium/Standard_5/plagiarism.pdf)

Extra help and tips for Success

Help is available in a variety of forms.

- Work with your classmates on difficult material.
- Get a tutor. The Chemistry office (GMCS 209) or I can also help you to find one.
- There will be a review session the Thursday before each exam at 5:00 PM.

10 Musts to get a good grade:

- Attend all lectures.
- Read material in book and notes before lecture, prior knowledge will help you become engaged in lecture and better comprehend material.
- Write questions down, and attend office hours.
- Do assigned homework (worth more than an exam!).
- Discuss concepts with classmates, or study partner.
- **Don't fall behind!**
- Try to see the big picture. Organic chemistry builds upon itself. Many of the topics within a chapter are just a slight

variation of something you learned. Apply yourself.

- Be curious. Always ask why? Curiosity makes a scientist tick.
- Focus on understanding concepts, not memorization.
- Actively read tests and notes… every few minutes you should try a problem.
- With Studying it is quality not quantity. Focus on comprehension not memorization.

Chapter Problem Assignments

Highly recommended problems in Chem 130. (These problems can be found either within or at the end of each chapter.)

Chapter 1 (Covalent Bonding and Shapes of Molecules):
1,2,3,4,5,6,7,8,10,11,12,13,14,15,16,22,23,24,25,26,27,28,31,32,35,36,37,39,41,42,44,47,48,50,51,52,53,54,56,57,60

Chapter 2 (Acids and Bases):
1,2,3,4,5,6,7,8,10,11,13,14,15,17,18,19,25,26,27,28,30,31,32

Chapter 3 (Alkanes and Cycloalkanes):
1,2,3,4,5,6,7,8,10,11,12,13,14,15,16,17,18,19,22,23,24,25,27,29,31,32,34,36,38,41,43,46,47

Chapter 4 (Alkenes and Alkynes):
1,2,3,4,5,9,10,11,12,15,16,17,18,21,22,24,28

Chapter 5 (Reactions of Alkenes and Alkynes):
2,3,4,5,6,7,8,11,12,13,14,15,16,17,18,19,21,22,23,24,25,26,27,28,33,38,40

Chapter 6 (Chirality: The Handedness of Molecules):
1,2,3,4,5,6,7,8,9,10,14,15,17,18,19,20,21,22,23,25,26,29,32,33,36

Chapter 7 (Haloalkanes):
1,2,3,4,5,6,7,8,9,11,12,13,14,15,16,17,20,21,22,24,25,26,27,31,32,33,36,38,40,43

Chapter 8 (Alcohols, Ethers, and Thiols):
1,2,3,4,5,7,8,9,10,11,12,13,15,16,18,20,22,23,24,25,28,30,31,32

Chapter 9 (Benzene and its Derivatives):
1,2,5,7,9,10,11,12,13,14,15,16,17,18,20,24,25,26,27,28,29,36,37,38,39

Chapter 10 (Amines):
1,2,3,4,5,6,7,8,10,11,12,14,15,16,17,18,19,20,21,22,25,29,30,31,34

Chapter 11 (Skip!)

Chapter 12 (Aldehydes and Ketones):
1,2,3,4,5,6,8,10,15,16,18,19,20,21,23,24,25,26,34

Chapter 13 (Carboxylic Acids):
1,2,3,5,7,8,9,10,11,12,13,14,15,16,17,20,21,22,23,25,26,27,28,29,33,34,35,36,37,39,40,41

Chapter 14 (Functional Derivatives of Carboxylic Acids, up section 14.6):
1,2,3,5,9,12,13,14

Chapter 18 (Amino Acids and Proteins):
1,2,3,4,8,9,10,11,12,13,14,15,22,23,24,26,29,33,36,37

Lecture and Exam schedule; Chem 130, Spring 2019

Monday	*Tuesday*	*Wednesday*	*Thursday*	*Friday*
21-Jan *MLK-Day*	**22-Jan**	**23-Jan** *Chapter 1 Introduction*	**24-Jan**	**25-Jan** *Ch.1 cont.*
28-Jan *Ch.1 cont.*	**29-Jan**	**30-Jan** *Ch.1 cont.*	**31-Jan**	**01-Feb** *Chapter 2*
04-Feb *Ch.2 cont.*	**05-Feb**	**06-Feb** *Ch.2 cont.*	**07-Feb**	**08-Feb** *Chapter 3*
11-Feb *Ch.3 cont.*	**12-Feb**	**13-Feb** *Ch.3 cont.*	**14-Feb**	**15-Feb** ***Midterm Exam 1***
18-Feb *Chapter 4*	**19-Feb**	**20-Feb** *Ch.4 cont.*	**21-Feb**	**22-Feb** *Chapter 5*
25-Feb *Ch.5 cont.*	**26-Feb**	**27-Feb** *Ch.5 cont.*	**28-Feb**	**01-Mar** *Chapter 6*
04-Mar *Ch.6 cont.*	**05-Mar**	**06-Mar** *Ch.6 cont.*	**07-Mar**	**08-Mar** *Chapter 7*
11-Mar *Ch.7 cont.*	**12-Mar**	**13-Mar** *Ch.7 cont.*	**14-Mar**	**15-Mar** ***Midterm Exam 2***
18-Mar *Chapter 8*	**19-Mar**	**20-Mar** *Ch.8 cont.*	**21-Mar**	**22-Mar** *Ch.8 cont.*
25-Mar *Chapter 9*	**26-Mar**	**27-Mar** *Ch.9 cont.*	**28-Mar**	**29-Mar** *Ch.9 cont.*
01-Apr *Spring Break*	**02-Apr** *Spring Break*	**03-Apr** *Spring Break*	**04-Apr** *Spring Break*	**05-Apr** *Spring Break*
08-Apr *Chapter 10*	**09-Apr**	**10-Apr** *Ch.10 cont.*	**11-Apr**	**12-Apr** ***Midterm Exam 3***
15-Apr *Chapter 12*	**16-Apr**	**17-Apr** *Ch.12 cont.*	**18-Apr**	**19-Apr** *Ch.12 cont.*
22-Apr *Chapter 13*	**23-Apr**	**24-Apr** *Ch.13 cont.*	**25-Apr**	**26-Apr** *Ch.13 cont.*
29-Apr *Chapter 14*	**30-Apr**	**01-May** *Ch.14 cont.*	**02-May**	**03-May** *Ch.14 cont.*
06-May *Chapter 18*	**07-May**	**08-May** *Ch.18 cont.*	**09-May** ***Last Day of Classes***	**10-May** *Final's Week Begins*
13-May *Final's Week* **Final Exam**	**14-May** *Final's Week*	**15-May** *Final's Week*	**16-May** *Final's Week*	**17-May** *Final's Week*

Friday midterm exams, 11-11:50 am, Feb. 15, Mar. 15, Apr. 12
Chemistry 130 Final: Monday May 13, 10:30-12:30 pm