Chem. 130 Organic Chemistry

Spring 2020

Schedule number: 20678

Professor Jeffrey Gustafson
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COURSE INFORMATION

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

Office Hours: M 945-1045, W12-100
Office Hours Location: CSL 208

Course Overview

Chem 130 covers the fundamental organic chemistry needed for fields related to health and the environment. Importantly this class will prepare students for Chem 160 (biochemistry), and thus we will spend time on applications of organic chemistry to biochem (after all biochem is just applied organic chemistry). Organic chemistry differs from general chemistry in that it focuses on only a few elements (C, H, N, O, F, Cl, Br, I). The 3-dimensional shape of molecules is particularly important and thus a molecular model kit (sold at book store) is HIGHLY recommended (and will be allowed on exams). We will also discuss fundamental organic transformations and how they care applied to everyday life.

Enrollment Information

Prerequisites: The prerequisite for Chem 130 is Chem 100. **If you have not taken Chem 100 or Chem 200, then you should not be taking this course.** (Note: Other college chemistry courses may qualify as a prerequisite. I will consider these and you should see me after the first day of class.)

Course Materials

Required Text: Introduction to organic chemistry by William H Brown and Thomas Poon (Wiley)

**** **This is an immediate Access Course:** Some or all of the required course materials for this class are provided in a digital format by the first day of classes and are free through the add/drop date of **February 4th, 2020**. Your SDSU student account will then be charged a special reduced price for use of the materials for the remainder of the semester unless you opt-out of the content by 11:59 PM on the add/drop date **February 4th, 2020**. Please visit www.shopaztecs.com/immediateaccess for additional information about Immediate Access pricing, digital subscription duration, print add-ons, opting out and other frequently asked questions. ****

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

Electronic Homework: The best way to learn organic chemistry is through doing it. Thus ~18% of the classes' grade (150 points scaled based on percentage of HW points received) will be from homework. Unfortunately hand graded homework is not feasible so we have to turn to online homework. We will be using the online homework that comes with the textbook via Wiley plus. I will assign approximately 1/2 hour of homework per chapter. The homework will be due the night (1159 PM) before the exam that covers that chapter. IT IS BEST TO DO THE HOMEWORK AS WE GO RATHER THAN TO WAIT UNTIL THE DAY IT IS DUE. Late homework will not be accepted under any circumstances (including due to technical glitches the night it is due). To make up for any poor questions or technical glitches, the homework score will be curved up at the end of the semester as needed.

Lecture Notes: The PPT notes of the class will be put up on Blackboard. These notes cover the major topic I will go over, **but are not a replacement for coming to class and reading the book!!** Lectures will be recorded and posted on blackboard.

Course Structure and Conduct

This course will be taught in a traditional lecture 'chalk talk' format. **It is imperative you start the post-chapter homework as we cover the chapter in lecture**. It is also important that you read the book and do the pre-lecture homework before lecture so that you are somewhat familiar with the material as I present it. As there is a large amount of material to be covered, I ask that questions be saved for before class, during my office hours, or after my lecture. The best advice for this class is to be proactive. Start the homework early, come to my office hours 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 (150 points each) and one final (250 points). **Dates: Exam 1 (chap 1-3): Feb 14th. Exam 2 (chap 4-7): March 13th Exam 3 (chapter 8-12): April 17 th.** Chapters 13&14 will be represented on the final exam.
Final Exam: Monday May 11th, 1030-1230 SHW011
There will be three 1 hour midterm exams during the semester, **each worth 150 points**. There will be 50 multiple choice questions. The 2 hour final exam is cumulative and is worth **250 points**. If beneficial your final exam score can replace your lowest exam score. **Because of this 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, **but never downward.** If necessary the class average of each exam will be curved upward 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…basically the type of questions that will be asked on exams) The included schedule is tentative and subject to change:

Chapter 1-Covalent bonding and Shapes of molecules (1/22-1/29)

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: (1/31-2/5)

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: (2/7-2/12)
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: (2/17-2/19)
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: (2/21-2/26)
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: (2/28-3/4)
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 (3/6-3/11)
1) Name simple Haloalkanes 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) Describe the products and 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 (3/16-3/20)
1) Name simple alcohols, ethers and thiols using IUPAC rules and understand the characteristic physical properties of each.
2) Understand the reactivities of alcohols, ethers and thiols.
3) Understand the basic properties of an epoxide (a special cyclic ether).

Chapter 9- Benzene and its derivatives (3/23-3/27)
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.
4) Understand the basic mechanism of electrophilic aromatic substitution and how substituents effect the reaction outcome

Chapter 10-Amines (4/6-4/8)
1) Understand the chemical and physical properties of amines and how to name simple amines using IUPAC Nomenclature
2) Understand the characteristic reactivities of amines (basic, generally good nucleophiles).

*****Chapter 11 will be skipped*****

Chapter 12-Aldehydes and Ketones: (4/10-4/15)
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: (4/20-4/24)
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) (4/27-5/1)
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 (5/4-5/6)
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 and labs.
- 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.
- 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.