Organic Chemistry I | Lecture and Lab

Academic Year 2020-2021

Course Information

Course Numbers	Total Credits	Time Requirement
OCHEM311/OCHEM311L	**4 (3 Lecture + 1 Lab)**	**75 hrs (Lecture 45hrs + Lab 30hrs)**

Course Details

Recommended Prerequisites

General Chemistry I and II are highly recommended.

Course Description

The course will begin with a review of some of the major concepts in organic chemistry. The chemistry of carbon compounds will be distinguished from inorganic chemistry. The various classes of aliphatic and aromatic compounds will be examined. The diversity of functional groups will be explored with regarding to reactivity and mechanism. Nucleophilic and electrophilic reaction mechanisms will be stressed. Stereochemistry will be explored. Biochemical and physiological analogies will be used throughout the course.

Lecture and Laboratory Communication

A website will be set up on Canvas by your instructor.
Log in with your Username and password: **https://scuhs.instructure.com**

Faculty Information

Refer to the Canvas course webpage for this information.

Class Meeting Times

Refer to Canvas course webpage for this information.

Instructional Materials

Required Text(s)

Lecture: Organic Chemistry with Biological Topics 6th Edition by Janice Smith and Heidi Vollmer-Snarr
ISBN: 1260516393 (Connect©) or Organic Chemistry (8th Edition) by L. G. Wade Jr ISBN-10: 0321768418

Lab

SCU Organic Chemistry Laboratory Manual (available on Canvas)

SOUTHERN CALIFORNIA UNIVERSITY OF HEALTH SCIENCES

Course Purpose

Student Learning Outcomes

At the conclusion of this course, a successful student should be able to:

1. Draw the structure of organic molecules and identify the functional groups (CLO 1-3)
2. Analyze the structure of organic compounds by recognizing main functional groups, naming the compounds using the I.U.P.A.C. system, and predicting their properties using the type of bonding, hybridization state, intermolecular forces and stereochemistry. (CLO 6-9)
3. Describe mechanisms of reactions: free radical, nucleophilic substitution, elimination and electrophilic addition, and apply this knowledge to predict the major product in organic reactions, such as those involving hydrocarbons, alcohols, alkyl halides, and alkenes. (CLO 10-51)
4. Analyze the nature of a reagent: as a nucleophile, free radical, or electrophile and use this knowledge to propose the synthesis of organic compounds, such as hydrocarbons, alkyl halides, alcohols, or alkenes. (CLO 10-51)
5. Demonstrate proficiency in organic laboratory skills as they pertain to: chemical information, safe handling, use and disposal of organic compounds; synthetic procedures, including isolation, purification, and structure elucidation of obtained products; stoichiometry and use of instrumentation; and writing of laboratory notebooks and reports in accordance with current scientific journals style. (CLO 1-51)

Course Learning Objectives: Please refer to the appendix for a full list of course objectives.

Course Schedule

(subject to slight modifications by the instructor)

Day	Lecture	Reading	Assessment
1	Structure and Bonding	Chapter 1	Class Participation
2	Acids and bases	Chapter 2	Class participation
3	Introduction to Organic Molecules and Functional Groups	Chapter 3	Exam 1
4	Alkanes Stereochemistry	Chapter 4 Chapter 5	Class participation
5	Understanding Organic Reactions	Chapter 6	Exam 2
6	Alkyl Halides and Nucleophilic Substitution Structure Alkyl Halides and Elimination Reaction	Chapter 7 Chapter 8	Class participation
7	Alcohols, Ethers and Related Compounds	Chapter 9	Exam 3
8	Alkenes and Alkynes	Chapter 10	Class participation
9	Oxidation and Reduction Conjugation, Resonance and dienes	Chapter 11 Chapter 12	Class participation
10	**Review and final exam**		**Exam 4**

Tentative Grading Procedures

Lecture

Assessment	Points	Weight (%)
Exam 1	100	~16%
Exam 2	100	~16%
Exam 3	100	~16%
Exam 4	100	~16%
Participation	60	10%
Homework	150	25%
Total	610	100%

Lab Schedule

(subject to slight modifications by the instructor)

Day	Laboratory	Assessment
1	Check-in: Check in/safety	Lab notebook
2	Experiment 1: Melting Point	Lab notebook
3	Experiment 2: Thin Layer Chromatography	Quiz 1
4	Experiment 3: Synthesis of Aspirin	Lab notebook
5	Experiment 4: Simple Distillation and Fractional Distillation	Lab notebook Quiz 2
6	Experiment 5: Modeling Molecules	Lab notebook
7	Experiment 6: Analysis Of “Panacetin”	Lab notebook Quiz 3
8	Experiment 7: SN1-Alkyl Halides	Lab notebook
9	Experiment 8: The Williamson Ether Synthesis	Lab notebook
10	Review/Checkout	Quiz 4

Tentative Grading Procedures

Lab

Assessment	Points	Weight (%)
Lab Quizzes (4 x 50 points)	200	52
Lab Notebook	180	47
Participation	5	1
Total	385	100

Lab Notebook:

- Pre-Lab: 40% of Total Assignment points (includes title, purpose, hypothesis, materials, procedure, plelab questions and worksheets)
- Post Lab: 50% of Total Assignment points (includes data, observations, calculations, post lab questions and conclusion)
- Neatness, grammar and clarity: 10% of Total assignment points

Grading scale:

Please note letter grades will be assigned only at the end of the trimester.

A = 90% to 100%

B = 80% - less than 90%

C = 70% - less than 80%

D = 60% - less than 70%

F = less than 60%

W = Withdrawal

Grading procedures:

The format of this assessment may include multiple choice, short answer, labelling, fill-in-the-blank, or calculation examinations. Participation points are required and will be assigned by the instructor as the course progresses through your general performance and regards for the rules of the laboratory and safety procedures.

Academic Integrity

Visit SCU's **Academic Integrity** page to review policies for professionalism and academic integrity.

Teaching Methods And Activities

Because of the demands of the course, successful chemistry students don't wait until exam time to begin studying. Instead, you should plan to follow the chemistry rule that every hour spent in class requires two to three hours of effort outside of class to succeed in this course. As an example, let's say you've just been assigned reading on Lewis structures. Don't let a day go by without learning how to write and interpret Lewis structures. Future work will most likely use these bonding diagrams, and they are likely to reappear in lectures, quizzes and exams. Procrastination doesn't simply mean that you won't understand Lewis structures—you'll also be lost for every subsequent reading and lecture that employs these diagrams. Staying on top of work and avoiding procrastination will help you build foundational knowledge and ensure you are equipped to learn subsequent material.

Lecture Exams:

There will be a total of 4 non-cumulative tests given during the course of this class. Each test will cover any and all material (lecture + homework + assigned reading) from the previous week of class. The tests will include multiple choice and free response questions, and there will be partial credit for only correct works shown for free response questions.

Lecture Participation:

Points are received from participation during in-class activities. Attendance is not the same thing as participation. Students are expected to be involved and engaged in all classroom activities (which may include formative quizzes and other assessments graded on participation).

Attendance:

Punctual attendance at each of your regularly scheduled laboratory and period is required. Additionally, you are required to stay until you and/or your group have completed the experiment. Check out with your lab instructor before leaving the laboratory after completing the experiment. You are expected to attend every one of your scheduled lab meeting times. However, if you find yourself in a situation where you are unable to attend lab, please email your instructor right away.

Required Attire

Close-toed shoes, professional attire and lab coats are mandatory during all lab hours. No shorts, heels, or flip-flops will be allowed in the laboratory; hair longer than shoulder-length must be pulled back and held with a clip or hair tie. Gloves, goggles and additional safety equipment will be required per experiment.

Laboratory Quizzes will be given the week after your experiment and its modality will be indicated by the Professor. These quizzes will be closely based on the reports and prelabs.

Evaluation of Experimental Technique: You will be assessed on your general performance and regards for the rules of the laboratory and safety procedures.

Attendance for lab: Punctual attendance at each of your regularly scheduled laboratory and period is required. Additionally, you are required to stay until you and/or your group have completed the experiment. Check out with your lab instructor before leaving the laboratory after completing the experiment. You are expected to attend

every one of your scheduled lab meeting times. However, if you find yourself in a situation where you are unable to attend lab, please email your instructor right away.

Classroom Expectations

Please be professional, prompt, prepared, and polite at all times.

The professor will adhere to all policies as found in the Student Handbook. Cellular phones must be kept on silent during class and lab times. Students may not use a phone as a calculator. As a safety precaution, no food or drinks are allowed inside the lab, but there will be a designated break for eating and drinking outside of the lab.

Best Practices for Studying Chemistry

- Read before and read after each class. Skim the chapter before it is covered in lecture to become comfortable with some of the terms associated with each topic. Review each chapter after it is covered in class to enhance your understanding of what was covered in class.
- Participate during class by taking notes during class and looking over them afterwards. Don't skip class, arrive late, or leave early. Ask questions for clarification when you don't understand the material.
- Stay on top of the homework and assignments. Do the assigned problems as close to the time as when the topic is covered in the class to increase the depth of your understanding of specific concepts and will help you learn the material more efficiently and effectively.
- Do not wait until the night before the homework is due to start the assignment. You will get more out of it if you take the time to really learn the concepts and review the material without being rushed.
- Find a group of students to study with. Seek out students dedicated to doing well in the course. This makes studying more fun and helps you learn the material better by teaching what you know and learning from your peers what you don't know. Explaining these concepts to others will help you learn the material even better.
- Stay focused by finding an environment where you can study with few distractions.

University Policies

Accommodations

As a learning-centered community, Southern California University of Health Sciences recognizes that all students should be afforded the opportunity to achieve their academic and individual potential. The University recognizes and supports the standards set forth in Section 504 of the Rehabilitation Act and

the American with Disabilities Act (ADA). In accordance with its mission and federal and applicable state laws, the University is committed to making reasonable accommodations for qualified applicants for admission and enrolled students with disabilities. A student who needs accommodation(s) due to a disability should contact the Academic Support Office located in the Learning Resource Center.

Faculty and Dr./Patient Relationships

SCU faculty are highly skilled. However, per University Policy, health care is offered to students through the University Health System only. Neither preclinical nor clinical faculty can provide advice, assessment, treatment, or other elements that would be considered part of a Doctor-Patient relationship outside of a clinical setting established for that purpose.

Learning Activities

Students are expected to spend at least two hours for each lecture hour of course time per week in activities and assessments outside the classroom. Examples of activities include, but are not limited to: writing papers; reading articles or text; small group work; presentations; completing assignments; preparation for assessments; online activities and other activities that do not include direct instructor interaction and involvement.

All university policies apply to this course and all others. For full policy information please consult the university SCU Policy Manual. For a quick reference guide to the following policies: make-up examination, F-challenge examination, grade posting, results of failing grades, student support information, syllabus amendments, special needs, student conduct, and attendance, please consult the academic policies document housed on the **Online Student Services .**

Appendix A: Course Learning Objectives

At the conclusion of this course, a successful student should be able to:

Structure and Bonding

1. Examine concepts of general chemistry relevant to organic chemistry principles
2. Identify patterns of covalent and ionic bonding with compounds of C, H, O, N, and halogens.
3. Draw and interpret the types of structural formulas commonly used in organic chemistry.

Acids and Bases

4. Identify acids, bases,
5. electrophiles and nucleophiles structures.

Organic Molecules and Functional Groups

6. Be able to predict the hybridization and geometry of organic molecules based on their bonding.
7. Be able to identify isomers and explain the differences between them.
8. Predict general trends in physical properties such as boiling points and solubilities.
9. Identify the general classes of organic compounds.

Alkanes

10. Be able to draw and name the isomers of alkanes and explain the trends in their physical properties.
11. Understand and be able to draw alkane conformations, compare their energies, and predict the most stable conformations.
12. Be able to draw and name the isomers of cycloalkanes and explain ring strain.
13. Draw the conformations of cycloalkanes, compare their energies, and predict the most stable conformations.

Stereochemistry

14. Be able to recognize structures that have stereoisomers and identify the relationships between the stereoisomers.
15. Be able to identify chiral structures, draw their mirror images, and identify features that may suggest chirality.
16. Identify asymmetric carbon atoms and other stereocenters and assign their configurations.
17. Be able to explain the relationships between optical activity and chirality, optical purity, and enantiomeric excess.
18. Explain how the different types of stereoisomers differ in their physical and chemical properties.

Understanding organic reactions

19. Propose mechanisms and explain the steps for simple reactions such as free-radical halogenation.
20. Draw a reaction-energy diagram and use it to identify the factors controlling the thermodynamics and kinetics of a reaction.
21. Use the mechanism, thermodynamics, and kinetics of a reaction to predict which of several possible products is the major product.
22. Identify reactive intermediates and explain their properties.

Alkyl Halides: Nucleophilic Substitution and Elimination

23. Be able to name alkyl halides, explain their physical properties, and describe their common uses.
24. Predict the products of substitution and elimination reactions, and explain what factors favor each type of reaction.

25. Identify the differences between first-order and second order substitutions and eliminations, and explain what factors determine the order of the reaction.
26. Be able to predict which mechanism(s) and product(s) are most likely when reaction conditions are given.

Alcohols

27. Determine the structure, name, bonding and physical properties of alcohols.
28. Understand the preparation of alcohols, ether and epoxides.
29. Be able to convert an alcohol to an alkene though dehydration.
30. Be able to convert alcohol to alkyl halides though the use of different reagents.
31. Understand the reactions of ether, thiols and sulfides and their applications.

Alkenes

32. Draw and name alkenes and cycloalkenes.
33. Given a molecular formula, calculate the number of double bonds and rings.
34. Explain how the stability of alkenes depends on their structures.
35. Be able to show how alkenes can be synthesized by eliminations from alkyl halides and alcohols.
36. Explain why electrophilic additions are among the most common reactions of alkenes.
37. Predict the products of the reactions of alkenes, including the orientation of the reaction (regiochemistry) and the stereochemistry.
38. Be able to propose mechanisms to explain the observed products of alkene reactions.
39. Be able to use retrosynthetic analysis to solve multistep synthesis problems with alkenes as reagents, intermediates, or products.

Alkynes

40. Determine the structure, name, bonding and physical properties of alkynes.
41. Be able to synthesize alkynes.
42. Understand Alkyne Reactions
43. Identify the atoms or compound that can be added to alkynes
44. Understand oxidation of alkynes
45. Understand the reaction of Acetylide Anions

Oxidation and Reduction

46. Identify the compounds used as reducing agents.
47. Understand the reduction of Alkenes alkynes and CX bonds.
48. Identify the compounds used as Oxidizing Agents
49. Understand epoxidation and dihydroxylation
50. Understand how oxidative cleavage can happen with alkenes and alkynes.
51. Perform oxidation on alcohols