

Sul Ross State University
Syllabus for Organic Chemistry I: CHEM 3407 (Fall 2019)

Class: Organic Chemistry I
Room: WSB 307
Time: MWF 9:00-9:50am
Lab: Wednesday 2:00-4:50 pm

Instructor: Dr. David Leaver
Office: WSB 318
Office Hours: M-R 2:00-5:00pm
Email: david.leaver@sulross.edu
Office Phone: (432) 837-8115

OBJECTIVES

Student Learning Objectives (SLO):

A student graduating with the *chemistry major* is expected to demonstrate that (s)he is able to do the following:

1. Organic Chemistry—Students will be able to draw organic molecular structures and explain organic reactions, stereochemistry, structural analysis and reactions in biological systems.
2. Inorganic Chemistry—The student will be able to demonstrate understanding of coordination chemistry, valence theory, elementary actions and advanced molecular theory.
3. Analytical Chemistry—The student will be able to demonstrate an understanding of theory of analytical chemistry and conduct analytical analysis, including data analysis and calibration, equilibrium chemistry, gravimetric analysis, titrimetric analysis, spectroscopic analysis, and electrochemical analysis.
4. Physical Chemistry—The student will be able to demonstrate an understanding of the application and theory of physical chemistry, including topics such as atomic structure, electrochemistry, surface chemistry, solid-state chemistry, and thermodynamics.
5. Research—The student will collect and analyze published chemical literature and undertake a chemistry research project.

Organic Chemistry Learning Objectives:

At the end of this course, a student should have a good understanding of:

- A. The language of aliphatic based organic chemistry
- B. The major functional groups in organic compounds
- C. Retrosynthetic analysis to design simple and complex organic molecules
- D. Applications of thermodynamic and kinetic principles to predict regiochemical and stereochemical outcomes of organic reactions
- E. Infrared (IR), nuclear magnetic resonance (NMR) and mass spectroscopy

REQUIRED TEXTS AND RESOURCES:

“Organic Chemistry” by T. W. Solomons, C. B. Fryle and S.A. Snyder (11th ed.), **2014**, John Wiley & Sons

The SRSU library has one copy of this textbook in the “Textbook Collection” section. Please ask the library front desk if you need help finding this textbook.

Suggested reading: “Survival guide to organic chemistry: bridging the gap from general chemistry” by Patrick E. McMahon, Bohdan B. Khomtchouk and Claes Wahlestedt, **2017**, CRC Press, Taylor & Francis Group.

The SRSU library has one copy of this book in the “Textbook Collection” section. Please ask the library front desk if you need help finding this book.

Lab Manual: “Techniques and Experiments for Organic Chemistry” (6th Edition) by A. Ault, **1998**, University Science Books

Molecular model set recommended (soft jelly candy with toothpicks can work!)

Scientific calculator recommended

The following chapters will be covered:

Chapter 1: The Basics: Bonding and Molecular Structure

Chapter 2: Families of Carbon Compounds: Functional Groups and Intermolecular Forces

Chapter 3: Acids and Bases: Introduction to Organic Reactions and Their Mechanisms

Chapter 4: Nomenclature and Conformations of Alkanes and Cycloalkanes

Chapter 5: Stereochemistry: Chiral Molecules

Chapter 2.15: Infrared Spectroscopy & Chapter 9: Nuclear Magnetic Resonance and Mass Spectrometry: Tools for Structure Determination

Chapter 6: Ionic Reactions: Nucleophilic Substitution and Elimination Reactions of Alkyl Halides

Chapter 7: Alkenes and Alkynes I: Properties & Synthesis

Chapter 8: Alkenes and Alkynes II Addition Reactions

Chapter 10: Radical Reactions

Chapter 11: Alcohols and Ethers: Synthesis & Reactions (*If time permits*)

HOMEWORK:

There will be a homework assigned for each chapter covered. **HARD COPIES OF YOUR HOMEWORK NEED TO BE TURNED IN BY THE DUE DATE AND NO LATE HOMEWORK WILL BE ACCEPTED.**

NOTE: Homeworks and Exams MUST be completed in pen!

EXAMINATIONS:

There will be *three in-course* examinations and *a final* examination. **NO MAKE-UP EXAMS WILL BE GIVEN.** The final is mandatory and comprehensive.

ATTENDANCE PRERESQUITE: BEING ABSENT FROM MORE THAN 9 LECTURES WILL RESULT IN FAILING THE COURSE.

PERCENTAGE BREAKDOWN OF MARKS:

Homework: 15%

Each Midterm Exam (15%): 45%

Final Exam: 20%

Laboratory: 20%

Midterm Exam I: Monday September 23rd

Midterm Exam II: Wednesday October 23rd

Midterm Exam III: Monday November 18th

Final Exam: Tuesday December 10th (8:00-10:00 am)

Course Calendar

Lecture 1 (August 26): Discussion on Syllabus, background of organic chemistry, overview of chemical bonding

Lecture 2 (August 28): Lewis structures and formal charges, resonance structure, basics of hybridization, bond lengths, geometric isomerism and three dimensional formulas

Lecture 3 (August 30): Structural basics of hydrocarbons; revision on Chapter 1

September 2: NO CLASS: LABOR DAY HOLIDAY

Lecture 4 (September 4): Introduction to functional groups (*Homework Chapter 1 due*)

Lecture 5 (September 6): Physical properties and molecular structure

Lecture 6 (September 9): Intermolecular forces; revision on Chapter 2

Lecture 7 (September 11): Overview on acid base theories and reactions (*Homework Chapter 2 due*)

Lecture 8 (September 13): Factors affecting acidity of compounds

Lecture 9 (September 16): Introduction to organic acids and bases, acid base reactions involving organic molecules

Lecture 10 (September 18): Revision on Chapter 3 (*Homework Chapter 3 due*)

Lecture 11 (September 20): Exam Revision

Lecture 12 (September 23): Exam I (Chapters 1,2 & 3)

Lecture 13 (September 25): Nomenclature and physical properties of alkanes and cycloalkanes and derivatives thereof

Lecture 14 (September 27): Conformational isomerism of alkanes and cycloalkanes

Lecture 15 (September 30): Synthesis of alkanes and index of hydrogen deficiency

Lecture 16 (October 2): Revision on Chapter 4

Lecture 17 (October 4): Isomerism, constitutional and stereoisomers, chiral molecules (*Homework Chapter 4 due*)

Lecture 18 (October 7): Nomenclature and physical properties of enantiomers

Lecture 19 (October 9): Introduction to synthesis of chiral molecules, molecules with more than one stereogenic center.

Lecture 20 (October 11): Revision on Chapter 5, Introduction to IR Spectroscopy

Lecture 21 (October 14): IR Spectroscopy & NMR Spectroscopy (*Homework Chapter 5 due*),

Lecture 22 (October 16): NMR Spectroscopy and Mass Spectroscopy (MS)

Lecture 23 (October 18): Revision on IR, NMR and MS, Nucleophilic substitution reactions, basic mechanism, kinetics and examples of S_N2 , (*Homework for Chapter 9 due*).

Lecture 24 (October 21): Exam revision

Lecture 25 (October 23): Exam II (Chapters 4, 5 & 9)

Lecture 26 (October 25): S_N1 reaction mechanism and stereochemistry of nucleophilic, factors affecting the rate of S_N1 and S_N2 reactions substitution reactions

Lecture 27 (October 28): Functional group transformation using S_N2 reactions; Revision on Chapter 6

Lecture 28 (October 30): Introduction to elimination reactions, E2 and E1 mechanisms and examples, and substitution vs elimination (*Homework Chapter 6 due*)

Lecture 29 (November 1): Synthesis of alkenes and alkynes by elimination reactions and acidity of terminal hydrogen of alkynes, hydrogenation of alkenes and alkynes

Lecture 30 (November 4): Introduction to retrosynthetic analysis & addition reactions to alkenes; Chapter 7 Revision

Lecture 31 (November 6): Addition of hydrogen halides to alkenes & synthesis of alcohol from alkenes via addition reactions (*Homework Chapter 7 due*)

Lecture 32 (November 8): Addition of halogens to alkenes and alkynes, oxidation of alkenes and alkynes

November 11: NO CLASS: VETERANS DAY HOLIDAY

Lecture 33 (November 13): Revision on Chapter 8, free radical reactions of alkanes (*Homework Chapter 8 due*)

Lecture 34 (November 15): Exam Revision

Lecture 35 (November 18): Exam III (Chapters 6, 7 & 8)

Lecture 36 (November 20): Free radical reactions of alkenes, revision on Chapter 10

Lecture 37 (November 22): Structure and nomenclature of alcohols, general physical and chemical properties of alcohols (*Homework Chapter 10 due*)

Lecture 38 (November 25): Reactions of alcohols, overview of reactions of carbonyl compounds with nucleophiles

November 27-29: NO CLASS: THANKSGIVING HOLIDAY

Lecture 39 (December 2): Revision on Chapter 11 (*Homework Chapter 11 due*), final exam revision

Lecture 40 (December 4): Final exam revision

Final Exam (Comprehensive) (Tuesday December 10): 8:00-10:00 am

Students with Special Needs: *Sul Ross State University is committed to equal access in compliance with the Americans With Disabilities Act of 1973. It is the student's responsibility to initiate a request for accessibility services. Students seeking accessibility services must contact Mary Schwartz, M. Ed., L.P.C., in Counseling and Accessibility Services, Ferguson Hall, Room 112. The mailing address is P.O. Box C-122, Sul Ross State University, Alpine, Texas 79832. Telephone: 432-837-8203. E-mail: mschwartz@sulross.edu.*

Scholastic Dishonesty: *Students who violate the University rules on scholastic dishonesty are subject to penalties, including the possibility of an **F** in the course and/or dismissal from the University. All assignments (including homework) need to be individually completed and not copied from another student's work.*