

Sul Ross State University
Syllabus for Organic Chemistry II: CHEM 3408 (Spring 2021)

Class: Organic Chemistry II
Room: WSB 101
Time: MWF 9:00-9:50am
Lab 01: Wednesday 2:00-4:50pm
Lab 02: Thursday 2:00-4:50pm

Instructor: Dr. David J. Leaver
Office: WSB 318
Virtual Office Hours:
M-R 2:00-5:00pm (phone or Zoom)
Zoom (appointments only)
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.

BSc in Chemistry Marketable Skills

1. Students will become good at punctuality and time management.
2. Students will analyze &/or synthesize molecules and perform spectroscopic characterization and interpret their results scientifically.
3. Students will become proficient at writing scientific papers and to identify appropriate references for their paper.
4. Students will be become proficient at orally presenting scientific topics including the use of visual aids.

Organic Chemistry II Learning Objectives:

- A. The language of aromatic based organic chemistry
- B. Reactions and mechanisms of compounds with carbonyl and amino groups
- C. In depth retrosynthetic analysis to design complex organic molecules
- D. Basic organometallic reactions and catalytic cycles
- E. How to write a chemical essay in the language of organic chemistry
- F. SciFinder (Chemical Database)

REQUIRED RESOURCES AND TEXTS:

You must wear a suitable mask/face covering while on campus. You will be asked to leave the classroom if you come to class without a suitable mask/face covering.

<https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/diy-cloth-face-coverings.html>

Assigned seating students: please pick a seat in the classroom and you will be required to sit in the same seat for every class you attend in person.

Disinfection of Classroom Surfaces: Each person should disinfect their space at the beginning and end of every class meeting. The university has provided disinfectant wipes in the classroom. When you enter the classroom, please take a

wipe and use it to clean your space before settling in. Please wipe down your space before you leave the classroom.

Orderly Dismissal: When class is over, Dr. Leaver will dismiss students row by row. Please wipe down your desk/leave when Dr. Leaver dismisses your row.

Food & Drinks: There will be no eating or drinking in the classroom. If you need to take a sip of your drink during class time, you may leave the room to do so.

If you have tested positive for COVID-19 (or have been exposed to someone who has tested positive for COVID-19), please self-report: <https://srinfo.sulross.edu/covid-19/self-report/>. In order to self-report you will need to be signed in with your SRSU credentials (yellow “log in” button on the bottom left hand side of the above website).

Cell phones ARE NOT permitted for use in exams and should be turned off during class time.

SRSU Library Services: The Sul Ross Library offers FREE resources and services to the entire SRSU community. Access and borrow books, articles, and more by visiting the library’s website, library.sulross.edu. Off-campus access requires your LoboID and password. Check out materials using your photo ID. Librarians are a tremendous resource for your coursework and can be reached in person, by email (srsulibrary@sulross.edu), or phone (432-837-8123).

ChemDraw is a computer program that you can use to draw organic structures, organic reactions, etc. You can download ChemDraw onto your own personal computer (PC or Mac):

<http://sitelicense.cambridgesoft.com/sitelicense.cfm?sid=3000>

Make sure you follow the requirements for the password and use your SRSU email address to register.

Alternatively you can access ChemDraw in the GIS lab (computer room next to the chem TA room) by searching for “ChemDraw” whenever there is no class in that room (open computer lab when no classes are being taught).

REQUIRED TEXT:

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

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 optional)

Suggested reading: “Survival guide to organic chemistry: bridging the gap from general chemistry” by Patrick E. McMahan, 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.

The following chapters will be covered:

Chapter 11: Alcohols and Ethers: Synthesis & Reactions

Chapter 12: Alcohols from Carbonyl compounds

Chapter 13: Conjugated Unsaturated Systems

Chapter 14: Aromatic Compounds

Chapter 15: Reactions of Aromatic Compounds

Chapter 16: Aldehydes and Ketones: Nucleophilic Addition to the Carbonyl Group

Chapter 17: Carboxylic Acids and their Derivatives

Chapter 18: Reactions at the α Carbon of Carbonyl Compounds: Enols and Enolates

Chapter 19: Condensation and Conjugate Addition Reactions of Carbonyl Compounds

Chapter 20: Amines

Chapter 21: Phenols and Aryl Halides: Nucleophilic Aromatic Substitution

Special Topic G: Carbon-Carbon Bond-Forming and Other Reactions of Transition Metal Organometallic Compound (*if time permits*).

Homework: There will be problems assigned for each chapter. **NO LATE HOMEWORK WILL BE ACCEPTED.** Homework must be completed in **PEN!**

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

LABORATORY: Attendance to laboratories is required. **NO MAKE-UP LABORATORIES WILL BE GIVEN.** If you **miss 3 labs** or more you will receive an automatic **F** for this course (i.e. this means you will fail the entire Organic II course).

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

RESEARCH ESSAY/REVIEW:

You will be assigned a named chemical reaction in class (more details will be provided in class and on Blackboard) and you will be required to provide at least 5 different examples of your assigned named chemical reaction, preferably from 5 different original journal articles. You will need to include the chemical structures of the starting materials, reagents, solvents, products, reaction yield, etc. You will also need to provide the reaction mechanism (including curved arrows) and provide a chemical description of what is occurring in the reaction. Use of appropriate chemical nomenclature is important in addition to the correct citation of references per ACS guidelines. **Due Monday April 19th @ 11:59 pm CDT.**

PERCENTAGE BREAKDOWN OF MARKS:

Homework: 15%

Each Midterm Exam (12%): 36%

Research Essay 14%

Final Exam: 15%

Laboratory: 20%

Midterm Exam I: Wednesday, February 10th

Midterm Exam II: Wednesday, March 3rd

Midterm Exam III: Wednesday, April 14th

Research Essay: Monday, April 19th (Due @ 11:59 pm CDT)

Final Exam: Tuesday, May 4th at 8:00-10:00 am

Course Calendar

Lecture 1 (January 11): Discussion on syllabus, structure and nomenclature of alcohols, general physical and chemical properties of alcohols (*online recording*)

Lecture 2 (January 13): Reactions of alcohols, overview of reactions of carbonyl compounds with nucleophiles (*online recording*)

Lecture 3 (January 15): Revision on Chapter 11 (*online recording*)

January 18: Martin Luther King, Jr. holiday (No Class)

Lecture 4 (January 20): Preparation of alcohols from carbonyl compounds (*online recording*)

Lecture 5 (January 22): Oxidation of alcohols, reactions of organolithium and organomagnesium compounds (*online recording*) (**Homework Chapter 11 due**)

Lecture 6 (January 25): Revision on Chapter 12

Lecture 7 (January 27): Allylic substitution reactions

Lecture 8 (January 29): 1,3-butadiene and stability of conjugated dienes (**Homework Chapter 12 due**)

Lecture 9 (February 1): 1,4 addition on conjugated dienes, Diels-Alder reaction

Lecture 10 (February 3): Revision on Chapter 13; Review on aromatic compounds. Nomenclature of benzene derivatives (**Homework chapter 13 due**)

Lecture 11 (February 5): Differences between alkenes and benzenes compounds in terms of general reactions

Lecture 12 (February 8): Exam revision

Lecture 13 (February 10): Exam I (Chapters 11-13, subject to change)

Lecture 14 (February 12): Stability of benzene; Revision on Chapter 14

Lecture 15 (February 15): Electrophilic aromatic substitution reactions
(Homework chapter 14 due)

Lecture 16 (February 17): Friedel-Crafts alkylation/acylation

Lecture 17 (February 19): Effect of substituents on reactivity and orientation, synthetic applications, revision on Chapter 15

Lecture 18 (February 22): Nomenclature of aldehydes and ketones, synthesis of aldehydes and ketones, nucleophilic addition to the carbon-oxygen double bond
(Homework chapter 15 due)

Lecture 19 (February 24): Synthesis of hemiacetals and acetals, addition of primary and secondary amines to carbonyl groups, Wittig reaction; Revision on Chapter 16

Lecture 20 (February 26): Nomenclature and physical properties of carboxylic acids and acid derivatives, preparation of carboxylic acids (Homework chapter 16 due)

Lecture 21 (March 1): Exam revision

Lecture 22 (March 3): Exam II (Chapters 14-16 subject to change)

Lecture 23 (March 5): Synthesis and reactions of esters and amides

March 8-12th is Spring Break (No classes)

Lecture 24 (March 15): Decarboxylation of carboxylic acids, summary of the reactions of carboxylic acids and their derivatives, review on Chapter 17

Lecture 25 (March 17): Reactions via enols and enolate anions (Homework chapter 17 due)

Lecture 26 (March 19): Acetoacetic and malonic ester syntheses, enamine chemistry

Lecture 27 (March 22): Review on Chapter 18

Lecture 28 (March 24): Claisen & Dieckmann condensation reactions, **(Homework chapter 18 due)**

Lecture 29 (March 26): Aldol condensations continued

Lecture 30 (March 29): Addition to unsaturated aldehydes and ketones

Lecture 31 (March 31): Synthesis of substituted acetic acids, Michael additions, summary of important reaction of dicarbonyl compounds Revision on Chapter 19.

April 2: Good Friday (No Class)

Lecture 32 (April 5): Nomenclature and physical properties of amines, basicity of amines, amines vs. amides, preparation of amines **(Homework chapter 19 due)**

Lecture 33 (April 7): Reactions of amines, revision on Chapter 20

Lecture 34 (April 9): Structure and nomenclature of phenols, physical properties and synthesis of phenols **(Homework chapter 20 due)**

Lecture 35 (April 12): Exam revision

Lecture 36 (April 14): Exam III: Chapters 17-19 (subject to change)

Lecture 37 (April 16): Reactions of phenols

Lecture 38 (April 19): Reactions of phenols continued. *Research Essay due @ 11:59 pm CDT.*

Lecture 39 (April 21): Revision on Chapter 21

Lecture 40 (April 23): Special Topic G **(Homework chapter 21 due)**

Lecture 41 (April 26): Revision on Special Topic G, Final Exam Revision

Lecture 42 (April 28): **Final Exam Revision (Homework Special Topic G due)**

Final Exam (May 4): 8:00 am-10:00 am in WSB 101 (comprehensive)

ADA Statement: *Sul Ross State University is committed to equal access in compliance with the Americans With Disabilities Act of 1973. Students with qualifying disabilities who seek accommodations must initiate a request for a meeting for accessibility services. Students seeking accessibility services must contact Rebecca Greathouse Wren, M.Ed., LPC-S, Counseling & Accessibility Services, Telephone: 432-837-8203, or E-mail: rebecca.wren@sulross.edu*
For more information see: <https://www.sulross.edu/page/1384/accessibility-services>

Please inform Dr. Leaver and Organic Chemistry TA if you are pregnant or get pregnant during this semester as chemicals used in the Organic Chemistry laboratory could have harmful effects on an unborn child and extra safety precautions and due diligence need to be taken into consideration during laboratory periods.

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. Electronic submission of homework must be hand written and scanned (either with a scanner or a smart phone) and emailed to Dr. Leaver at: david.leaver@sulross.edu. [.pdf files are the preferred format for electronically submitted homework.]*