Catalog Description: Organic Laboratory – synthesis and characterization of organic compounds

Prerequisite: CHE 134 & 134L (or their equivalents) with a minimum grade of “C”

Corequisite: You must be currently enrolled in CHE 331 or have already had CHE 331 (or its equivalent)

Required Materials:

- Access to an organic chemistry lecture text (Brown, Klein, Wade, etc.)
- Notebook paper & pencils
- Lab handouts will be posted on D2L throughout the semester. It is your responsibility to print these out, study them, and bring them to lab with you
- A scientific calculator—Bring to lab with you EVERY TIME!

Laboratory Notebook: You must use a spiral-bound lab notebook.

- If you took CHE 133L/134L at SFA, you will use the same type of notebook.
- You might be able to use the same notebook you used for CHE 133L/134L, however, this can only be done with approval of the instructor
- Notebooks may be purchased from Dr. Frantzen (M119) for $20 (cash only).
- This type of notebook is the ONLY type that will be allowed for this lab. No other type of notebook will be accepted.

Required Supplementary Readings:

Handouts will be posted prior to each lab. You are expected to read and study these handouts carefully and use them to prepare for lab.

Course Objectives:

Students will learn principles of organic chemistry in the laboratory. In the process, they will familiarize themselves with a broad range of techniques and procedures important to the successful practice of experimental organic chemistry. Special emphasis will be placed on:

- the safe handling of chemicals
- the proper manipulation of labware and instrumentation specific to the organic chemistry laboratory
- the maintenance of proper laboratory experimental records
- the use of basic MS, IR, and NMR spectroscopic methods of structural elucidation
- the use of scientific report writing as a means of communicating experimental results and as a means of demonstrating an overall understanding of the chemical principles and concepts used during laboratory activities.

Student Learning Outcomes: By the end of the semester, the student should be able to:

- Follow a published procedure to:
  - Perform an organic reaction successfully
  - Isolate and purify the product of an organic reaction
- Analyze spectroscopic data (MS, IR, 1H-NMR) in order to:
  - Elucidate the correct structure of a molecule
  - Assign correctly various spectral attributes and features to a particular portion of a molecule’s structure
- Write a good laboratory report including:
  - Recording his/her procedure, data, and observations in the laboratory notebook
  - Demonstrating in writing that he/she understood the chemical & physical principles involved in laboratory techniques & manipulations
  - Following established principles & conventions for communicating laboratory data & results
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Course Requirements:
Your grade will be determined by evaluating your performance in lab activities. A list of these activities and their weight in the overall semester grade is shown below:

<table>
<thead>
<tr>
<th>Lab Activity</th>
<th>% of Semester Grade</th>
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</thead>
<tbody>
<tr>
<td>Spectroscopy Quizzes (Best 3 grades of 4)</td>
<td>10%</td>
</tr>
<tr>
<td>Lab Quizzes (3 during semester; all count)</td>
<td>10%</td>
</tr>
<tr>
<td>Recrystallization Report (short)</td>
<td>10%</td>
</tr>
<tr>
<td>Distillation Report (short)</td>
<td>10%</td>
</tr>
<tr>
<td>TLC Report (short)</td>
<td>10%</td>
</tr>
<tr>
<td>Polymerization Report (short)</td>
<td>10%</td>
</tr>
<tr>
<td>Extraction Report (long)</td>
<td>30%</td>
</tr>
<tr>
<td>Major Spectroscopy Quiz (Best grade of 2)</td>
<td>10%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

**Method of Evaluation:**

The purpose of this lab is to teach you the common techniques used in the synthesis and isolation of organic compounds. O-Chem lab is an experiential course. You are expected to learn from participating in the experiment using the knowledge you have gained from the lecture portion of the class to improve your laboratory results. You will **NOT** be given all of the information you will need! You are expected to be resourceful and learn to find information on your own. **While the instructors will do their best to ensure your safety, each student is responsible for his/her own learning from the laboratory activities.**

**Spectroscopy Quizzes:**

Spectroscopy is how we determine the structure of an organic molecule, and is one of the most important skills in organic chemistry. We will practice these skills early so we can utilize these skills in CHE 331L as well as in CHE 332L. You should become very familiar with the spectroscopy chapters from your lecture text while also using chapters 32 & 33 from Zubrick’s “The Organic Chem Lab Survival Manual”. Along with the examples done in class, you must practice spectroscopy problem-solving techniques using a lecture text. We will have four spectroscopy quizzes during the semester. The dates are listed in the schedule. Your professor will let you know what to expect for each quiz. Your best three (3) quiz grades will be counted for your semester grade; i.e. your lowest **non-zero** quiz grade will be dropped. A quiz grade of zero that is the result of an unexcused absence will NOT be dropped, but rather will be counted for the semester grade. **Two major spectroscopy quizzes** will also be given (check schedule for dates). The best one of these two grades will count toward your semester grade; i.e. your lowest **non-zero** major spectroscopy quiz grade will be dropped. A quiz grade of zero that is the result of an unexcused absence will **NOT** be dropped, but rather will be counted for the semester grade.

**Lab Quizzes:**

Three lab quizzes will be given in order to assess how well you understand the techniques and chemical principles and concepts used during the lab. Rather than memorizing the procedure word-for-word, you should ensure that you understand what was done during the lab and **why it was done**. The dates for these quizzes are listed in the schedule. All three of the lab quizzes count toward your semester grade; none of them will be dropped.
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**Lab Reports:**

Most of the lab activities will require you to write a short report over what was done, what results were obtained, and what conclusions can be drawn from the results. You will be given specific information for these reports vis-a-vis format, content, due date, etc. Follow these directions. All of them.

One lab activity (Extraction) will require you to write a longer, more detailed lab report.

- Each person is responsible for writing his/her own report.
- Lab reports are to be typed on white, unlined 8½ in x 11 in paper using 1 inch margins on all sides. Lab reports must only be printed on one side. Lab reports that are printed on two sides of the paper will NOT be accepted.
- Your reports should be **DOUBLE-SPACED** and should use 12 pt font. You may ONLY use either Times New Roman or Arial font for lab reports.
- Your reports should be spell-checked AND proofread before submitting them. Your reports should not contain any spelling, grammar, or punctuation errors.
- No cover sheet is needed. Please DO NOT include one. Fancy bindings are also not needed. A simple staple is all you need.
- **Pay attention to the maximum page length specified for the report. Reports that exceed the maximum number of pages will receive a substantial penalty.** This means that you need to be concise, get straight to the point, say what is needed, and then move on. Don’t include a bunch of BS.
- You are welcome to consult with your lab professor for assistance when writing the report. If you do, you need to bring a printed hard copy of the report to the professor’s office. Come during the professor’s office hours or email your professor to make an appointment.

Please pay careful attention to due dates for lab reports. Reports that are turned in after the due date are subject to a 15-POINT PENALTY PER DAY (including weekends and holidays). **Turn your lab reports in on time!**

**Notebook & Pre-Lab Outline:**

The student should be prepared for the experiment prior to the laboratory. This is primarily a safety concern, but prepared students often complete experiments more efficiently and obtain the necessary data required to write excellent reports. Organization is clearly important, and is the most important feature of the laboratory notebook. A well-organized organized notebook is more important than a neat notebook. Notebook mistakes can be crossed out and corrected (as long as a brief explanation for the correction is inserted and dated in the margin) for accuracy. An outline that covers the procedure to be performed must be prepared on LOOSE-LEAF PAPER prior to lab. This may either be handwritten or done on a computer (your choice). Your pre-lab outline MUST NOT be written within your lab notebook. The pre-lab outline should be done in a stepwise, “cookbook” fashion. You should use the outline as your primary source for guidance while performing the lab. Failure to prepare a proper outline prior to lab will result in a loss of all lab technique points for that activity. In addition, you will not be allowed to enter the lab until you have prepared a proper outline. This might result in you not having a sufficient amount of time to perform the day’s experiment, and can result in you being sent home for the day. If this should happen, you can expect to receive a substantial penalty on the lab in question.

The notebook is the most important document produced during the laboratory. It is this information that will be used for the writing of reports, and the determination of how modification of the experiment may affect change. **You must NEVER erase or white-out anything from the notebook!** Everything written into the notebook should be permanent, thus you should only write in black ink. The first experiment will be used to demonstrate the value of a good lab notebook.

**Note:** If you drop the course, you MUST still check out of lab. If you check out at the end of the semester and do not clean your equipment satisfactorily, your course grade will be penalized by one letter grade!
Attendance Policy: You cannot do the lab if you are not present (obviously)

- There are no "make up" labs.
- You are responsible for notifying the professor [NOT the TA] (in writing) if you know that you will have to miss a lab
- If you miss one laboratory for an excused reason (as defined by the SFA Policies and Procedures Manual), you can be allowed to complete a lab activity during another lab activity (only on the day that you are scheduled to be in lab). This is only allowed with the professor’s explicit permission.
- If you miss a laboratory for an unexcused reason, you will receive a grade of zero (0) on that lab and any quiz that might be given on the day missed.
- A total of two unexcused absences will result in a grade of zero on the missed lab AND your semester lab grade will be lowered by one letter grade
- Three or more absences will result in an automatic F in the course
- If there are extenuating circumstances (e.g. serious illness, hospitalization, etc.), you are responsible for notifying the professor as soon as possible

Semester Withdrawals:

Please note: The last day to drop this course without receiving a WP or WF on your transcript is Wednesday, Oct. 23rd. If you drop the course, you MUST check out of the lab also. If you do not check out of lab, the Registrar will not authorize the drop.

Academic Integrity Policy:

Each student should acquaint him/herself with the University's codes, policies, and procedures involving academic misconduct, grievances, sexual and ethnic harassment, and discrimination based on disability. Copies of the SFA Policies and Procedures Manual can be obtained in print or online from the Office of Academic Affairs (http://www.sfasu.edu/upp/pap/academic_affairs.html)

Students engaging in academic misconduct (including cheating, plagiarism, or any other action that can improperly affect evaluation) will be subject to sanctions in accordance with SFA Academic Integrity Policies. A grade of "F" for the course and expulsion from the University will be recommended for any such violations.

Academic Disabilities Policy:

Stephen F. Austin State University is committed to providing reasonable accommodation for all students with disabilities. Students with disabilities who require accommodations in this course are requested to speak with me as early in the semester as possible. Students with disabilities must be registered with the Office of Disability Services prior to receiving accommodations in this course. The Office of Disability Services is located in Human Services Bldg., Room 325, (936) 468-3004, or (936) 468-1004 (TDD).
Lab Conduct Policy:

- You are expected to pay careful attention during the pre-lab discussion. This is your time to ask questions if you are unsure of how to perform a particular manipulation. Texting, internet surfing, studying for other classes, or any other sort of behavior will NOT be tolerated. You will be kicked out of lab and will receive a grade of zero on that day's activities.
- You are expected to follow the departmental safety rules AT ALL TIMES while in lab. A copy of the departmental safety agreement will be provided for you to read and sign.
- Horseplay in the lab is ABSOLUTELY FORBIDDEN. If you are caught engaging in horseplay, you will be removed from lab for the day and will receive a non-droppable grade of zero (0) on that lab activity. **This is the only warning you will receive about horseplay.**
- Goggles must be worn AT ALL TIMES whenever ANYONE is working in the lab. If your goggles fog, step into the hallway to clean them. Failure to wear goggles in lab will result in you being removed from the lab for the day and receiving a grade of zero (0) on that lab activity. **This is the only warning you will receive about wearing goggles.**
- You are also expected to conduct yourself in a mature and responsible manner while in lab. NOTE: Usage of cell phones (including text messaging) while in lab is PROHIBITED. Turn your phones off before coming into lab. You will be removed from lab for the day and will receive a grade of zero (0) if you use your cell phone in lab.
- Lab begins promptly at the scheduled time. **BE ON TIME!** Chronic tardiness problems can result in penalties to your grade.
- You are NOT to re-start an experiment/activity in the lab without the express permission of the professor (NOT the TA). Students caught re-starting an experiment without permission can expect to receive a serious penalty on the activity, up to and including dismissal from the lab and a grade of zero (0) on the activity.
- You are expected to arrive for lab well-prepared for the scheduled activities. This includes having done any assigned reading and any other assigned pre-lab preparation.
- Repeated or serious conduct problems will result in you being removed from lab permanently, and can result in disciplinary action from the university.

Organic Laboratory Safety:

- You are not in freshman chemistry anymore. The organic lab can be a dangerous place. Many of the chemicals you will use are toxic, corrosive, flammable, or otherwise hazardous. You do not need to be afraid of these chemicals; however, you **DO need to have a healthy respect for them.** If you have a question about how to handle a chemical or piece of equipment properly, ask the TA or the professor.
- The best safety device you have in lab rests on your shoulders. You have a brain. Use it! Think **BEFORE** you do things.
- Many accidents or mishaps in lab can primarily be attributed to two main factors:
  - **Failure to prepare thoroughly for lab** - You MUST know what chemicals you will be using and know the hazards associated with them. Pay special attention to any special warnings or directions given in the text or handouts. Listen attentively during the pre-lab lecture. **Ask questions if you are unsure of how to handle a particular chemical or how to do a procedure. It is much better for you to ask and take a few minutes of class time than for you to do something incorrectly, ruin an experiment, or possibly create a safety hazard in the lab.**
  - **Momentary episodes of carelessness** - Many times students simply forget that they should (or should not) do something until they do it (or don't do it). At that point, it is too late. **THINK about what you are doing.** If you see a classmate doing something incorrectly, tell him/her. **A lot of these problems can be alleviated or even avoided through proper, thorough preparation.**
- A copy of the SFASU Department of Chemistry safety rules has been provided for you on D2L. **READ THEM!!!** You MUST sign this form before being allowed to participate in lab.
- You are expected to follow all safety rules AT ALL TIMES while in lab.
- **ATTENTION FEMALE STUDENTS: IF YOU ARE PREGNANT, OR IF YOU FIND OUT YOU HAVE BECOME PREGNANT WHILE TAKING THE LAB, PLEASE NOTIFY THE PROFESSOR AT ONCE!**
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- APPROVED SAFETY GOGGLES **MUST BE WORN IN THE LAB WHenever ANYONE IS Handling CHEMICALS! SAFETY GLASSES ARE NOT ALLOWED. IF YOU ARE CAUGHT NOT WEARING GOGGLES, YOU WILL BE KICKED OUT OF LAB AND WIlL RECEIVE A ZERO FOR THAT DAY’S LAB.** Goggles must fit tightly around the eyes and be “splash-proof”. Goggles are provided for you in your lab drawer. If the goggles do not fit properly, or are not comfortable, please notify the TA or the professor immediately so that we can get you better goggles.

- NO FOOD, DRINK, or TOBACCO USAGE is allowed in the lab! Water bottles, etc. should be kept in your backpack.

- NO EXPOSURE OF SKIN BELOW THE NECK, EXCEPT FOR THE ARMS is allowed in the lab!
  → This lab is a 100% “cleavage-free” zone. This applies to both front and back cleavage.
  → This means that tank-tops and sleeveless shirts are **NOT** allowed.
  → No shorts or open-toe shoes (sandals & flip-flops). **YOU WILL NOT BE ALLOWED TO PARTICIPATE IN LAB IF YOU ARE WEARING OPEN-TOED SHOES.** If you often wear flip-flops to class, we recommend that you store an old pair of tennis shoes in your lab drawer and change shoes before lab. In the warmer months, if you wear shorts to class, bring a pair of sweats with you and change before lab.
  → Wear comfortable shoes! You will be on your feet the whole time.
  → Don’t wear nice (or expensive) clothing or shoes to lab. You will get chemicals on them, even if you are careful. Oftentimes, you won’t even realize that you got something on your clothing *until you wash it and see a hole in it.*

- Backpacks must be stored on the racks on the lab benches, NEVER on the floor or benchtop.

**The only things you should have with you when doing the lab are: your lab notebook, pen, calculator, and pre-lab outline. Lab texts should NOT be out during lab.**
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<thead>
<tr>
<th>Date</th>
<th>Scheduled Activity</th>
<th>Reminders</th>
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<tbody>
<tr>
<td>08/27-08/29</td>
<td>Lab DOES NOT meet</td>
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<tr>
<td>09/03-09/05</td>
<td>Introduction &amp; class policies</td>
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<td>Mass spectrometry</td>
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<td>09/10-09/12</td>
<td>Organic functional groups</td>
<td>Spectroscopy Quiz #1</td>
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<td>Infrared spectroscopy</td>
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<td>09/17-09/19</td>
<td>Proton NMR spectroscopy (Part 1)</td>
<td>Spectroscopy Quiz #2</td>
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<td>09/24-09/26</td>
<td>Proton NMR spectroscopy (Part 2)</td>
<td>Spectroscopy Quiz #3</td>
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<td>10/01-10/03</td>
<td>Spectral problem-solving practice</td>
<td>Spectroscopy Quiz #4</td>
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<td>Lab safety discussion</td>
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<td>Check-in to lab</td>
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<tr>
<td>10/08-10/10</td>
<td>Recrystallization—Part 1</td>
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<td>10/15-10/17</td>
<td>Recrystallization—Part 2</td>
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<td>10/22-10/24</td>
<td>Distillation</td>
<td>Turn in Recrystallization report</td>
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<td>Lab Quiz #1 (Recrystallization)</td>
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<td>10/29-10/31</td>
<td>Thin Layer Chromatography</td>
<td>Turn in Distillation report</td>
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<td>Major Spectroscopy Quiz #1</td>
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<td>11/05-11/07</td>
<td>Extraction—Part 1</td>
<td>Turn in TLC report</td>
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<td>Lab Quiz #2 (Distillation &amp; TLC)</td>
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<tr>
<td>11/12-11/14</td>
<td>Extraction—Part 2</td>
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<td>Major Spectroscopy Quiz #2</td>
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<td>11/19-11/21</td>
<td>Polymerization of styrene activity</td>
<td>Turn in Extraction report</td>
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<td>Lab Quiz #3 (Extraction &amp; Polymerization)</td>
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<tr>
<td>11/26-11/28</td>
<td>Thanksgiving holiday</td>
<td>No lab activities scheduled</td>
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<tr>
<td>12/03-12/05</td>
<td>Clean up &amp; check-out of lab</td>
<td>Turn in Polymerization report</td>
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<tr>
<td>12/12-12/14</td>
<td>Finals Week</td>
<td>Lab DOES NOT meet</td>
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