Course and Contact Information

Instructor: Dr. Daniel Straus
Office Location: SCI-141
Telephone: (408) 924-4998
Email: daniel.straus@sjsu.edu
Office Hours: M 2:30-3:30 PM; T 2:30-4:00 PM
Class Days/Time: TR 10:30-1:20 PM and R 1:30-2:20 PM
Classroom: SCI 139

Prerequisites: Chem 113A (with grade of "C" or better; "C-" not acceptable), Chem 112B (may be taken concurrently with instructor's consent), and Chem 120CS. Transfer students should see the instructor and may be asked to provide information on prerequisite courses taken at other institutions (syllabi, coursework, texts, etc).

Course Format

Two three-hour laboratory sessions and one one-hour seminar per week

Canvas and MYSJSU Messaging

Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on the Canvas page for this course. I will also use the email address listed on your mySJSU account regularly to send information on Chem 112A - make sure your email is current. You are responsible for checking for messages on this email on a regular basis to learn of any updates. Many important files will be posted to Canvas, so be sure you check it frequently. If you are unable to access Canvas, let me know and I will refer you to the Canvas help desk.
Course Description:

**Catalog Description**  Continuation of Chem 113A including more advanced work. Prerequisite: Chem 113A (with a grade of "C" or better; "C-" not accepted). Pre/Corequisite: Chem 112B. Misc/Lab: Lecture 1 hour/lab 6 hours.

**Details:** Chem 113B is a continuation of Chem 113A, including more advanced laboratory techniques used in the isolation, purification, characterization, and synthesis of organic compounds. Emphasis will be placed on the practical skills and knowledge required to successfully carry out multi-step syntheses and to adapt or design laboratory procedures, rather than merely to follow "cookbook" instructions. Formal lab reports in ACS (Journal of Organic Chemistry) style will emphasize writing and communication skills. See the "Schedule of Experiments, Quizzes and Final" for the specific course content.

The scheduled lab time for this section is TR 10:30 to 1:20 PM. Since this course is based on practical experience, attendance for all scheduled lab and lecture sections is mandatory: repeated absences will affect your progress in the experiments and will likely have an effect on the final grade. More importantly, safety information is covered in lab lectures and missing these will make it unsafe, and therefore not possible, for you to begin the experiment. A lecture for this course is scheduled every Thursday at 1:30 to 2:20 PM. These lectures will describe general background and applications of several spectroscopic techniques that we will use in Chem 113B. (TENTATIVE SCHEDULE ATTACHED BELOW). In general, we will not cover problem solving during these Thursday sessions. You will be expected to work problems on your own, including from the textbooks, problem sets and handouts.

**Course Goals and Learning Objectives:** (These include but are not necessarily limited to the following)

- Demonstrate understanding of core concepts and to effectively solve problems in organic chemistry.
- Mastering advanced laboratory techniques for manipulation of organic compounds (synthesis, separation, purification)
- Characterization of organic compounds by physical and spectroscopic methods (see below)
- Use of infrared (IR), 1-D and 2-D proton NMR, and 13C NMR spectroscopies to characterize organic molecules.
- Apply mass spectroscopy (exact mass, and fragmentation patterns) to organic structural analysis.
- Select conditions for GC analysis and analyze GC chromatographic data.
- Maintain useful contemporaneous notes of experimental procedures.
- Write original formal laboratory reports in ACS journal style.
- Locate scientific data as needed.
- Design experimental procedures for new reactions, and modify existing procedures as needed. (deduce reasons for the success or failure of a procedure)
- Operate safely in the laboratory, and dispose of waste properly

**BS/BA CHEMISTRY PROGRAM LEARNING OUTCOMES ADDRESSED BY Chem 113B**

This class contributes toward program learning objectives 2&10, listed on the department website: http://www.sjsu.edu/chemistry/Academic_Programs/undergraduate_program_learning_objectives.html

**Required Texts/Readings (Required)**

**Textbook**


   NOTE: you must purchase the current Fall 2016 set of notes. Changes have been
(You must bring the entire booklet to each lab session)


**Other Needs**

Lab Notebook (one which allows for duplicate pages, e.g. National Brand 63-644)
Ruler (at least 6", preferably transparent)
Calculator (cell phones may not be used as calculators during a quiz or exam, and are strictly prohibited)
Pencils!
Organic chemistry molecular modeling kit.

**Lab Notebooks:**

The preliminary write-up of all notes and observations must be kept in a bound notebook that has pre-numbered duplicate pages. All entries must be made in pen - NEVER erase or use "white out"! RECORD ALL OF YOUR NOTES AND OBSERVATIONS DIRECTLY INTO THE NOTEBOOK, AND AS THEY OCCUR. In other words, don't write down numbers on scraps of paper and transfer them later, or try to memorize your measurements. The main purpose of the notebook is to be a "journal" for your laboratory activities to which you, or someone else, can read at a later date, and fully understand what you did, how you did it, and why the results came out the way they did. It's OK to scratch out entries - the main point is that it is organized and understandable. As you'll learn, in professional situations the lab notebook is considered a legal document, and there are rules about how they are prepared and maintained. In Chem 113B, one component of your grade will be based on your notebook!

**Cell Phones:**

*Use of cell phones is not permitted in the laboratory at any time. Please exit the lab for calls or texting.*

**Lab Reports:**

The accompanying guide describes many of the points involved in writing a concise and proper lab report. The Formal Report must be in the style of a Journal of Organic Chemistry ("JOC") article - see the ACS style guide, and any issue of JOC for details. The formal report must be typewritten or prepared by word processor, and one-and-one-half- or double-spaced. A typical report consists of:

1) a completed report summary (yellow 2-sided sheet),
2) the yellow carbon copy pages from your lab notebook,
3) the Formal Report
4) all appropriate *labeled* and interpreted spectra, and
5) the reaction product(s) – (Experiment 4 only, see below.)

As with a published paper, the formal lab report should be written so that someone with a basic understanding of organic chemistry will be able to understand your experimental procedure, results and conclusions, and be able to reproduce your experiment. In your discussion, pay particular attention to the key discussion points listed in the experimental handout provided. The written report must be original, in your own words, and properly referenced. Under no circumstances may any part of a report which has previously been turned in for a Chemistry 113B student be used in your report. All rules of academic integrity (see below) will be enforced. All of the reports for this class be submitted in electronic form to online monitoring program (turnitin.com).
Please turn in your report in a folder, with each section (1, 2, 3 and 4) kept separate. I will provide the folder. You may staple or paper clip the pages within each section - please don't staple all your pages into one large document. Put your name on at least the first page of each section.

Products:

Where requested (dimedone experiment only), your products should be submitted in clean vials that have labels with the following information:

<table>
<thead>
<tr>
<th>Your name</th>
<th>Name of Compound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (in g)</td>
<td>Mp or Bp (as measured by you)</td>
</tr>
</tbody>
</table>

Depending on the product, these will be graded on the basis of one or more of the following criteria: yield, melting / boiling point, appearance. Products must be turned in at the same time as your report.

Schedule of Experiments:

Experiments and due dates are given in the "Schedule of Experiments" handout. (ATTACHED BELOW)

Note that the lab report and all supplementary material are due at the beginning of the lab period for the specific "due date." A detailed prelab lecture about each experiment will be given on or before the "start date" of each experiment. In addition, supplemental lectures may be given as needed. The Schedule is subject to change and changes will be announced in class.

You will be given the starting material for each experiment only after the instructor checks both your preliminary writeup in your notebook, and the table of reagents and products. Your starting material will be provided to you in a vial, which you will swap for an empty vial. If you need a second sample of starting material, you may be assessed a penalty.

A major requirement for success in Chem 113B is advance preparation. This means you should read the experimental background and procedures carefully before the lab period. Since many of the experiments use more that one text, or multiple sections of a text, one suggestion is to photocopy the most important part of the procedures and have this as a ready reference (especially if only a few pages are involved). Note that you MUST have your preliminary writeup and table of reagents and products completed BEFORE you will be given any starting material. Obviously, if you have to work on these items during the scheduled lab period, you will seriously deprive yourself of adequate bench time to complete the experiment. A less obvious benefit of advanced planning will be that you may be able to use time during long procedures (e.g. refluxing) to perform other aspects of the experiment to catch up or get ahead. The lab schedule is arranged so there should be adequate time to complete each experiment well within the allotted dates.

Grading / Attendance:

The final course grade* will be determined on a 100 point basis as follows:

5 experiments @ 10% each* = 50%
(80 pt report and 20 pt quiz)

5 spectroscopy quizzes @ 40 pt each** = 20%
Grades will be assigned on a "+/-" system. The course grades will be assigned according the following ranges:

<table>
<thead>
<tr>
<th>Grade</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>A+</td>
<td>100-96%</td>
</tr>
<tr>
<td>A</td>
<td>95-91%</td>
</tr>
<tr>
<td>A-</td>
<td>90-86%</td>
</tr>
<tr>
<td>B+</td>
<td>85-81%</td>
</tr>
<tr>
<td>B</td>
<td>80-76%</td>
</tr>
<tr>
<td>B-</td>
<td>75-71%</td>
</tr>
<tr>
<td>C+</td>
<td>70-66%</td>
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<tr>
<td>C</td>
<td>65-61%</td>
</tr>
<tr>
<td>C-</td>
<td>60-56%</td>
</tr>
<tr>
<td>D+</td>
<td>55-51%</td>
</tr>
<tr>
<td>D</td>
<td>50-46%</td>
</tr>
<tr>
<td>D-</td>
<td>45-41%</td>
</tr>
<tr>
<td>F</td>
<td>&lt;40%</td>
</tr>
</tbody>
</table>

You can use the scale above to estimate your grade. At the end of the semester, any modifications will be in your favor, but you should not expect significant changes. Note that the "class average" for a given exam is not necessarily a "C" grade. Grades are assigned by these grade ranges, not by "curves."

** A total of 6 spectroscopy quizzes will be given during the Wednesday 1:30 PM class periods (see schedule). You may take all 6 (lowest score will not be counted), or choose to take 5 quizzes (all quizzes count). If you miss a quiz for any reason, this will be the quiz that does not count for your grade.

There will be a penalty of 20 points per lab period for late reports. No reports will be accepted after the final exam.

The instructor may raise the final course grade by 0.33 grade point (eg., from B+ to A-) based on excellent preparation and laboratory work.

*It is mandatory that all five Formal Reports be turned in (even if late) in order to receive a passing grade (C or better) for CHEM 113B. (Turning in all reports, even on time, does not guarantee a passing grade, however.)*

All quizzes and the final exam are open to notes and textbooks used for Chem 113B. Each student must have his/her own set (no sharing during quizzes and exams).

Attendance at all lab meetings will obviously be essential for you to complete the experiments. In general, work outside of the scheduled lab time will not be allowed except in unusual circumstances (e.g. medical absence, with verification). Any request for special circumstances must be accompanied with a verifiable document (e.g. doctor's note). Work is such cases must be in another Chem 113B section and requires permission of both instructors – a special form can be obtained in the Service Center.

SAFETY:

Before you will be allowed to work in the laboratory, all students in Chem 113B must:

1. read the "Chemistry Department Safety Rules for Teaching Laboratories", and sign and turn in the sheet at the end of the document, indicating that you have read and understand the rules and regulations.
2. attend the safety lecture (first lab meeting), and
3. view the Safety film.
4. pass the safety quiz (80% or better).

All of the above conditions are mandatory, and must be completed before you will be allowed to work in the lab!

In addition to the points covered above, these are especially worth emphasizing:

1. ALWAYS WEAR SAFETY GOGGLES IN THE LAB!!! (over your eyes, not on your forehead!)
2. Be aware that we will be using some flammable solvents, do not have any flames when you (or someone else in the room) are handling these
3. Similarly, treat all acids, bases, and reagents as potential hazards. Avoid skin contact with all of these, and treat any contact immediately. If you have a spill, never leave it unattended (let the instructor know).
4. Glassware breaks. Use caution in any experimental procedure, and exchange any chipped or cracked glassware. Also, dispose of all glassware in the special bins, not in the trash cans!
5. You are absolutely required to follow any instructions provided by the instructor related to procedures and/or safety. Failure to do so will result in your immediate expulsion from this class.
6. If you are not sure, ask!!

In addition, for safety reasons, before you start an experiment, you are expected to fully understand the procedures and hazards involved, and follow the instructor's directions. Familiarize yourself with the safety section of the SJSU Catalog under the Chemistry Department. Note in particular: "Failure to comply with proper procedures and prescribed safety concerns shall subject the student to disciplinary action. 1) Any student who engages in unauthorized experimentation, or who seriously disregards safety, thereby endangering self or others shall be withdrawn immediately from the class with a grade of "F". 2) Any student who shows persistent disregard for safety may have his/her grade lowered, and may risk being withdrawn with a final grade of "F"."

Special rules of safety and conduct apply when using the Bruker 300 NMR and the HP GCD and other instruments. These will be provided by the instructor.

With preparation and organization, it will be possible to complete all of your lab work during the scheduled lab period. Except in unusual cases, no lab work will be permitted outside of the scheduled lab times. Usually, the only situation where this may be allowed is in cases of illness for which you provide verification by your doctor. In any case, under NO circumstances are you to work outside of your appointed lab period without the written approval of the 113B instructor. Any student found working without expressed permission outside of the lab time may be dropped from the class!

Chemical Safety (CHEM 120S):

Chemistry 120S (Chemical Safety) is a required course for all chemistry majors and minors, and a prerequisite for all students involved in Chemistry 180 or 298 research courses.

Equipment:

You will be assigned an individual locker of equipment for your use during this course. You will be checked into your locker during the first lab period by the instructor, and in doing so sign an acknowledgement that you have all of your equipment. You are responsible for keeping track of all of the contents of your drawer. If you lose or break any item, you will be assessed a breakage fee at the end of the semester, so be careful with your equipment. It is possible to complete this course with a relatively small bill for expendable items; it is also possible to end up with a >$100 bill! No one can help you if something is lost or broken, so be careful!

When you check in, you will be given a coded check out pad from the storeroom. You may use this pad to check out additional equipment from the storeroom which may be required for a particular experiment. Note that certain equipment items checked out must be returned the same day to avoid a late fee. Remember, the code on your pad is assigned to you only, don't lose it, or someone else can use your code!
Office:

My office is in Science 141. In addition to office hours, questions are also welcome anytime by email: daniel.straus@sjsu.edu

Final Grades:

Grades will not be posted due to personal security issues. If you would like your course and final exam grade, please provide me with a stamped and addressed envelope during the final exam.

Academic Integrity:

No form of cheating, copying, or other unfair advantage will be tolerated, and will be dealt with severely. A first infraction will result in “Fail” for that experiment or exam. A second will result in an automatic grade of "F" for the course. The underlying principle will be fairness to all students in the course. In particular, copying or plagiarism (the excessive use of someone else's words, even if acknowledged, see the section from the Academic Senate below) is considered a serious offense, especially with regard to the formal lab reports. Note that simply "re-ordering" words from another source does not constitute an original paper. You must use your own words and analysis in these reports.

Additionally, when you work on and turn in a report, it is expected that the work is your own only. While you may get general advice from your classmates and faculty members, you may not ask others to analyze your data for you. This includes faculty members at SJSU or other colleges/universities, trained professionals in the field, or any commercial services.

From the Office of Student Conduct and Ethical Development: “Your own commitment to learning, as evidenced by your enrollment at San Jose State University, and the University’s Academic integrity Policy requires you to be honest in your academic course work. Faculty are required to report all infractions to the Office of Student Conduct and Ethical Development. The policy on academic integrity can be found at http://sa.sjsu.edu/student_conduct.

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From the SJSU Academic Senate Resolution S04-12

1.2 PLAGIARISM:

At SJSU plagiarism is the act of representing the work of another as one's own (without giving appropriate credit) regardless of how that work was obtained, and submitting it to fulfill academic requirements. Plagiarism at SJSU includes but is not limited to:

1.2.1 The act of incorporating the ideas, words, sentences, paragraphs, or parts thereof, or the specific substance of another's work, without giving appropriate credit, and representing the product as one's own work; and

1.2.2 Representing another's artistic/scholarly works such as musical compositions, computer programs, photographs, paintings, drawings, sculptures or similar works as one's own.

BE SURE YOU UNDERSTAND WHAT PLAGIARISM MEANS. IF NOT, ASK!!

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Emergencies and Building Evacuations:

If you hear a continuously sounding alarm, or are told to evacuate the building by an Emergency Coordinator, walk quickly to the nearest exit (out the door and turn left to exit the Science Building). Take your personal belongings as you may not be allowed to return. Follow the instructions of the Emergency Coordinators. Be quiet so you can hear instructions. Once outside, move away from the building. Do not return to the building unless the Police or the Emergency Coordinator announces that this is permissible.
Maintenance on campus in compliance with Americans with Disabilities Act:

If you need course adaptations or accommodations because of a disability, or if you need special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 requires that students with disabilities register with EAC to establish a record of their disability.

Drop Policy:

University Policy will be followed. After the free drop period, documentation of serious and compelling reasons will be required for all drops. See the following for details: http://www.sjsu.edu/sac/.

Posted Materials:

Keys to exams will be posted in the laboratory only until the next test date. Be sure to record any correct answers you wish during that period, since these keys will not be available later.

Students planning to take CHEMISTRY 114:

If you plan to take Chem 114, note that the prerequisite of Chem 100W (or equivalent course approved by your advisor) will be strictly enforced. Students without a 100W course completed will not be allowed to enroll in Chem 114.

University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs’ Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/”
(Tentative Schedule of Experiments)

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Start Date</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check-In</td>
<td>Aug 25 (R)</td>
<td>---</td>
</tr>
<tr>
<td>0</td>
<td>Aug 30 (T)</td>
<td>Sept 20 (T)</td>
</tr>
<tr>
<td>1 (stilbene)</td>
<td>Sept 6 (T)</td>
<td>Oct 4 (T)</td>
</tr>
<tr>
<td>2 (menthol)</td>
<td>Oct 4 (T)</td>
<td>Nov 1 (T)</td>
</tr>
<tr>
<td>3 (ester)</td>
<td>Oct 20 (R)</td>
<td>Nov 22 (T)</td>
</tr>
<tr>
<td>4 (dimedone)</td>
<td>Nov 17 (R)</td>
<td>Dec 8 (R)</td>
</tr>
<tr>
<td>Check-out</td>
<td>Dec 8 (R)</td>
<td></td>
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</tbody>
</table>

Experiment reports are due at the start of the lab period indicated by the due date. Once the reports are collected, a Lab Quiz will be given, usually in the first 5-10 minutes of the lab period. You must be present to take the lab quiz!

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**Spectroscopy Quizzes / Final Exam Schedule**

- Spectroscopy Quiz One  
  22 Sept (R)
- Spectroscopy Quiz Two  
  13 Oct (R)
- Spectroscopy Quiz Three 
  27 Oct (R)
- Spectroscopy Quiz Four 
  10 Nov (R)
- Spectroscopy Quiz Five 
  1 Dec (R)
- Spectroscopy Quiz Six  
  3 Dec (R)

**FINAL EXAM**  
1215 - 1430, 16 December (Friday)

Lectures on the use of spectroscopic techniques in organic structure analysis will be given on the Wednesdays where quizzes are not scheduled.

All quizzes and the final exam are open to notes and textbooks used for Chem 113B. Each student must have his/her own set (no sharing during quizzes and exams). "e-Book" versions of these textbooks are NOT ALLOWED. Computers or any electronic devices are not allowed during quizzes and exams.

*Be sure to keep track of report due dates and when quizzes will be given!*

<table>
<thead>
<tr>
<th>DATE</th>
<th>TOPIC(S)</th>
<th>READING*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept 1</td>
<td>Intro to Structure Determination</td>
<td>PLK Ch 1 (all); Ch 2 (all-review); Ch 3 (all-review); Ch 4 (all)</td>
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<tr>
<td></td>
<td>Review of Hydrogen Deficiency Index (HDI)</td>
<td></td>
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<tr>
<td></td>
<td>Review Proton (^1)H NMR and IR</td>
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<tr>
<td></td>
<td>Introduce Carbon (^{13})C NMR</td>
<td>SWK Ch 2 (all); Ch 3 (all)</td>
</tr>
<tr>
<td>Sept. 8</td>
<td>Chemical Shift Interpretation and Prediction in (^1)H NMR and (^{13})C</td>
<td>PLK Ch 3 (3.6; 3.10; 3.11); Ch 4</td>
</tr>
<tr>
<td></td>
<td>NMR</td>
<td>(4.2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SWK Ch 3 (3.4; App A; App B.1; App B2a; App C; App D); Ch 4</td>
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<tr>
<td></td>
<td></td>
<td>(4.2.2; 4.3; 4.5; 4.7; App A-D)</td>
</tr>
<tr>
<td>Sept. 15</td>
<td>(^1)H NMR coupling constants and splitting &quot;trees&quot; Use of HDI and</td>
<td>PLK Ch 1 (all); Ch 3 (3.13-3.18); Ch 4 (4.13-4.16); Ch 5 (all)</td>
</tr>
<tr>
<td></td>
<td>Elemental Analysis; Rule of 13</td>
<td>SWK Ch 3 (3.5; 3.12-3.14; App F)</td>
</tr>
<tr>
<td>Sept. 22</td>
<td>Spectroscopy Quiz 1</td>
<td></td>
</tr>
<tr>
<td>Sept. 29</td>
<td>Isotopic vs Atomic Weights High Resolution Mass Spectroscopy (MS)</td>
<td>PLK Ch 8 (8.1-8.7)</td>
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<tr>
<td></td>
<td></td>
<td>SWK Ch 1 (1.1 to 1.5 all sections)</td>
</tr>
<tr>
<td>Oct. 6</td>
<td>Low Resolution MS; Elemental Analysis</td>
<td>PLK Ch 8 (8.1-8.7)</td>
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<tr>
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<td></td>
<td>SWK Ch 1 (1.5)</td>
</tr>
<tr>
<td>Oct. 13</td>
<td>Spectroscopy Quiz 2</td>
<td></td>
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<tr>
<td>Oct. 20</td>
<td>2-Dimensional NMR</td>
<td>PLK Ch 10 (10.7)</td>
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<td></td>
<td></td>
<td>SWK Ch 5 (5.1-5.4)</td>
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<tr>
<td>Oct. 27</td>
<td>Spectroscopy Quiz 3</td>
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<tr>
<td>Nov. 3</td>
<td>Mass Spectroscopy Fragments I</td>
<td>PLK Ch 8 (8.8)</td>
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<tr>
<td></td>
<td></td>
<td>SWK Ch 1 (1.5.4 to 1.6.17)</td>
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<tr>
<td>Nov. 10</td>
<td>Spectroscopy Quiz 4</td>
<td></td>
</tr>
<tr>
<td>Nov. 17</td>
<td>Mass Spectroscopy Fragments II</td>
<td>PLK Ch 8 (8.8)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SWK Ch 1 (1.5.4 to 1.6.17)</td>
</tr>
<tr>
<td>Nov. 24</td>
<td>Non-Instructional Day (no classes)</td>
<td></td>
</tr>
<tr>
<td>Dec. 1</td>
<td>Spectroscopy Quiz 5</td>
<td></td>
</tr>
<tr>
<td>Dec. 8</td>
<td>Spectroscopy Quiz 6</td>
<td></td>
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If time permits, additional topics may be included.


If you use earlier versions of these books, the chapters and sections will differ, so you will have to find the respective topics.

Problems in these books are not assigned, but you are encouraged to work on them to get additional practice! Additional problems will be provided in lecture and will be posted in Canvas Files. Also, ANY organic chemistry textbook will have basic spectroscopy questions for you to get more practice.