

San Jose State University Department of Chemistry

CHEM 113B, Organic Chemistry Lab II, Section 3-4, Spring 2021

Course and Contact Information

Instructor(s):	David Brook
Office Location:	Online (via Zoom, Canvas, email)
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Email:	david.brook@sjsu.edu
Office Hours:	ThTh 1:30-2:30 via zoom, and by appointment
Class Days/Time:	TuTh 10:30-1:20, Seminar online (asynchronous)
Classroom:	SCI 139/SCI 135
Prerequisites:	CHEM 113A or Equivalent (Grade of C or better)

Course Description

Continuation of CHEM 113A including more advanced work. Prerequisite: CHEM 113A (or equivalent with grades of "C" or better; "C-" not accepted). Pre/corequisite CHEM 112B

Course Format

This class follows a hybrid format with both in-person (in lab) and online components. You will be divided into two groups. One group will attend lab on Tuesdays, the other group on Thursdays. When it is not your day in lab you will have online assignments. There are also online seminars and quizzes

Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on the Canvas Learning Management System course login website at <http://sjsu.instructure.com>. For help with using Canvas see Canvas Student Resources page (http://www.sjsu.edu/ecampus/teaching-tools/canvas/student_resources)

Course Learning Outcomes (CLO)

Upon successful completion of this course, students will be able to:

1. Use advanced laboratory techniques for manipulation of organic compounds (synthesis, separation, purification)
2. Characterize organic compounds by physical and spectroscopic methods including:
 - *Infrared spectroscopy*
 - *1D ¹H and ¹³C NMR spectroscopy*
 - *2D NMR spectroscopy*
 - *Mass spectrometry (exact mass and fragmentation patterns)*
 - *X-ray crystallography*
3. Maintain useful contemporaneous notes of experimental procedures

4. Write original formal laboratory reports in ACS journal style
5. Locate scientific data as needed from paper and electronic sources as needed
6. Design experimental procedures for new reactions and modify existing procedures as needed
7. Operate safely in the laboratory and dispose of waste properly

Program Learning Outcomes (PLO)

Chemistry 113B satisfies the following Program Learning Outcomes for the Chemistry Department:

PLO #2 - Demonstrate understanding of core concepts and to effectively solve problems in organic chemistry.

PLO #6 - Answer questions regarding safe practices in the laboratory and chemical safety.

PLO #7 - Demonstrate safe laboratory skills (including proper handling of materials and chemical waste) for particular laboratory experiments.

PLO #10 - Write a formal scientific laboratory report, using the format and style of an article in a peer-reviewed American Chemical Society journal

Required Texts/Readings

Textbooks

Pavia, D.L.; Lampman, G.M.; Kriz, G.S. Introduction to Spectroscopy, 3rd ed. (Other editions acceptable)

Silverstein, R. M.; Webster, F. X.; Kiemle, D. J.; Spectrometric Identification of Organic Compounds, 7th ed. (Other editions are acceptable)

Other technology requirements

For the online portion of this class you will need a computer with internet access and webcam. In addition you will need to download and install several additional pieces of software. These are all available at no cost to you (either because of an SJSU site license, or because they are free software). Make sure you carefully follow the installation instructions and make sure the software works. In particular, MNova must be installed while connected to the campus network, though it may subsequently be used off campus.

Structure drawing:

Chemdraw: [https://informatics.perkinelmer.com/sitesubscription/Register.aspx?](https://informatics.perkinelmer.com/sitesubscription/Register.aspx?FlexeraAccountId=3371SL)

[FlexeraAccountId=3371SL](https://informatics.perkinelmer.com/sitesubscription/Register.aspx?FlexeraAccountId=3371SL)

Processing NMR and MS data:

MNova: [https://drive.google.com/drive/folders/1M_ShHFRYnah-KjbZ948OO4MQWWnG2WfQ?](https://drive.google.com/drive/folders/1M_ShHFRYnah-KjbZ948OO4MQWWnG2WfQ?usp=sharing)

[usp=sharing](https://drive.google.com/drive/folders/1M_ShHFRYnah-KjbZ948OO4MQWWnG2WfQ?usp=sharing)

3D modeling of molecular structures:

Avogadro: <http://www.avogadro.cc>

Olex2 and SHELX: The appropriate versions of Olex2 and SHELX can be found on canvas along with installation instructions.

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 sign an acknowledgment 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!

At the end of the semester, you must clean out your locker, replace all broken equipment or glassware, and have the instructor sign the check-out form. If this process is not completed fully, you may be charged a fee to clean and refurbish your locker.

Course Requirements and Assignments

Grades on this class are based on four lab reports (5% each) and six online assignments (5% each), five 'quizzes' (5% each) and a final exam (25%). To the greatest extent possible, lab reports should be based on data collected in the laboratory. External circumstances (i.e. COVID-19) may limit experimental work, in which case the instructor will provide make-up data. Make-up data may **only** be used with prior instructor authorization.

Lab Notebooks

The preliminary write-up of all notes and observations must be kept in a bound notebook with pre-numbered duplicate pages. All entries must be made in pen - NEVER erase or use 'white out'. Sometimes 'mistakes' turn out to be critical pieces of information! RECORD ALL OF YOUR NOTES AND OBSERVATIONS IN DIRECTLY IN YOUR NOTEBOOK, AS THEY OCCUR. Don't use scraps of paper; don't memorize measurements. The main point of the notebook is to be a journal of you laboratory activities so that you, or someone else, can read it at a later date and fully understand what you did, how you did it, and why things came out the way they did. It's OK to correct entries by drawing a line through them. The main point is that it is organized and understandable.

Lab Reports and online assignments

Each lab report has somewhat different requirements as detailed in the laboratory manual. Overall, reports follow the style of a "Journal of Organic Chemistry" article though different reports will focus on different sections (e.g. the experimental section). Pay particular attention to the required sections for each report. Your grade will suffer if you do not include the correct sections with appropriate content for each!

Reports must be typewritten, double spaced and submitted on 'Canvas'. Include electronic copies of all spectra and notebook pages with your online submission (photographs or scans are fine). I do not need hard copies of your notebook pages or the report itself. You should include chemical structures within your report. Free chemical drawing software for windows can be found at <http://www.acdlabs.com> ("Chemsketch) and <http://www.mdli.com> ("Isidraw"). Other packages include MarvinSketch and Chemdoodle. One of the most commonly used chemical drawing packages is ChemDraw (<http://www.cambridgesoft.com>) but it is not free. The chemistry department has a site license for chemdraw so that you can download it and use it for reports etc. for the duration of the class.

"Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally three hours per unit per week) for instruction, preparation/ studying, or course related activities, including but not limited to internships, labs, and clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus."

Final Examination or Evaluation

The final exam will be based on the spectroscopic aspects of this class.

“Faculty members are required to have a culminating activity for their courses, which can include a final examination, a final research paper or project, a final creative work or performance, a final portfolio of work, or other appropriate assignment.”

Grading Information

The final course grade will be based on the total score of assignments over the semester:

4 reports @ 5% each	20%
6 online assignments @ 5% each	30%
5 spectroscopy quizzes @ 5% each	25%
Final exam	25%
Total	100%

Grading rubrics for reports and assignments will be available on canvas.

Grades will be determined using the following scale

<i>Grade</i>	<i>Percentage</i>
<i>A plus</i>	<i>96 to 100%</i>
<i>A</i>	<i>93 to 95%</i>
<i>A minus</i>	<i>90 to 92%</i>
<i>B plus</i>	<i>86 to 89 %</i>
<i>B</i>	<i>83 to 85%</i>
<i>B minus</i>	<i>80 to 82%</i>
<i>C plus</i>	<i>76 to 79%</i>
<i>C</i>	<i>73 to 75%</i>
<i>C minus</i>	<i>70 to 72%</i>
<i>D plus</i>	<i>66 to 69%</i>
<i>D</i>	<i>63 to 65%</i>
<i>D minus</i>	<i>60 to 62%</i>

Laboratory Safety

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

- a. Attend the safety lecture (first lab meeting) and
- b. View the Safety film.
- c. Read the Safety Rules for Teaching Laboratories on the chemistry department website
- d. Pass a short quiz on laboratory safety (grade of 80% or above)

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:

- a. ALWAYS WEAR SAFETY GOGGLES IN THE LAB!!! (over your eyes, not on your forehead!)
- b. 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
- c. 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).
- d. 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!
- e. The texts have sidebars or highlighted sections outlining special safety precautions - always enter these into your procedure section in your notebook (another reason to read ahead!)
- f. 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 disenrollment from this class.
- g. 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 instructors directions. Familiarize yourself with the safety rules for teaching labs on the chemistry department website. 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 instruments. These will be provided by the instructor. If you have any question or uncertainty about use of any instrument do not hesitate to ask.

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 where more than a few periods are missed and 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 disenrolled from the class!

University Policies

Per University Policy S16-9 (<http://www.sjsu.edu/senate/docs/S16-9.pdf>), relevant university policy concerning all courses, such as student responsibilities, academic integrity, accommodations, dropping and adding, consent for recording of class, etc. and available student services (e.g. learning assistance, counseling, and other resources) are listed on Syllabus Information web page (<http://www.sjsu.edu/gup/syllabusinfo>), which is hosted by the Office of Undergraduate Education. Make sure to visit this page to review and be aware of these university policies and resources.

CHEM 113B / Organic Chemistry Lab II, Fall 2020, Course Schedule

Module	Dates	In lab	On line/Report	Seminar topic	Reading
Safety	Jan 28	No Lab	Lab Safety	Safety	
1	Feb 2,4	No Lab	Chemdraw (due feb 9)	Review of IR	Pavia - IR chapter Silverstein - Ch2
2	Feb 9,11	No lab	IR data processing	¹³ C NMR	Pavia – Ch 6, 9.4-9.5; Ch 5.1-5.6, 5.8, 5.10-5.12 (review) Silverstein – Ch 4; Ch 3.1-3.4, 3.8-3.9 (review)
3	Feb 16, 18	Check in	MNova (NMR) (due Feb 23)	¹ H NMR part 1	Pavia - Ch 5.1-5.6, 5.8, 5.10-5.12, 5.19 (review) Silverstein - Ch 3.1-3.4, 3.8-3.9 (review)
4	Feb 23, 25	Experiment 1A		Quiz 1	
5	Mar 2, 4	Experiment 1A	Experiment 1A Analysis and Report (due Mar 16)	MS part 1	Pavia Ch 8.1-8.7 Silverstein Ch 1.1 to 1.5.2
6	Mar 9, 11	Experiment 1B	MNova MS (due Mar 16)	MS part 2	Pavia Ch 8.1-8.8 Silverstein Ch 1.5.3 – 1.6.17
7	Mar 16, 18	Experiment 1B	Molecular Modeling with Avogadro (Due Apr 6)	Quiz 2	
8	Mar 23, 25	Experiment 1B	Experiment 1B report (Due Apr 6)	¹ H NMR part 2	Pavia – Ch 5.9, 5.13-5.18, 5.20, Ch 7 Silverstein – Ch 3.5, 3.12-3.14, 3.16
	Mar 30, Apr 1	SPRING	BREAK	SPRING	BREAK
9	Apr 6, 8	Experiment 1C	Intro to crystallography	Intro to Crystallography	

Module	Dates	In lab	On line/Report	Seminar topic	Reading
10	Apr 13, 15	Experiment 1C	Intro to crystallography (Due Apr 20)	Advanced NMR	Pavia – Ch 9.7 Silverstein – 5.1-5.4, 5.4.3-5.4.5, 5.8-5.8.1, 5.10-5.10.1
11	Apr 20, 22	Experiment 2	Experiment 1C Analysis and Report (Due Apr 27)	Quiz 3	
12	Apr 27, 29	Experiment 2	Structure determination (Due May 4)	Strategies for structure determination	
13	May 4, 6	Experiment 2	Experiment 2 analysis and report (Due May 11)	Quiz 4	
14	May 11, 13	Check out		Quiz 5	
Final Exam	May 19				