San Jose State University  
CHEMISTRY 113A  
ORGANIC CHEMISTRY LABORATORY & LECTURE  
Spring 2013 – Sections 01 and 08  
MW 1030-1320 (Sec 01) (SCI-154) and TR 1800-2050 (Sec 08) (SCI-139)  
Dr. Paul Gendler:  Office: SCI-140  phone: 924-4997  email: paul.gendler@sjsu.edu  
Office hours: MW 1000-1030, TR 1730-1800, or by prior appointment.  
Stockroom, SCI-150  924-4990  
Final Exams:  Sec 01 Monday, May 20  0945-1200  
Sec 08 Tuesday, May 21  1445-1700  
REQUIRED MATERIALS:  
b) Laboratory notebook  (Brooks/Cole 100-page Carbonless Duplicate Student Organic Chemistry Laboratory Notebook with Spiral Binding).  Other brands of (duplicate-page) consecutively numbered laboratory notebooks are acceptable.  
c) D.A. Straus, Notes for Chemistry 113A for Spring 2013 [purchase @ Maple press, which is located on San Carlos Street between 10th and 11th Streets)  
d) Transparent plastic metric ruler (six inch size is fine) @ bookstore and elsewhere.  
e) Regular use of the website www.turnitin.com, for submission of experimental conclusions.  
f) calculator  
In addition to the above, you will receive:  
From Instructor: 3 items  
1. Locker Inventory Card  
2. Department Safety Sheet  
3. Drop Policy (greensheet addendum)  
From Service Center (SCI-150): 2 items  
1. Equipment Pad  
2. Service Center Procedure Sheet/Price List  
COURSE WEB SITE: THIS IS A MUST!!  
We have developed a web site to help you visualize the techniques and experiments - it is a work in progress that has been supported in part though an LPP Award from the Office of Faculty Affairs. Use it often; consult it as a good way to prepare for each lab; it is an extremely valuable resource.  
http://www.chemistry.sjsu.edu/straus/visioche.htm  
Note: Test copies and keys for some sections from previous semesters are included on the web site. The course notes and web site are in the process of being revised for the new 4th edition of Pavia – expect your instructor to point out any changes to recommended reading.  
DESCRIPTION:  
“Catalog - Fundamental techniques for the isolation, characterization, and synthesis of organic compounds.  2 units.”  
This course introduces many of the basic techniques for synthesis, isolation, purification and identification of organic compounds. The emphasis is on practical laboratory skills. Sufficient theoretical background will be covered to permit the design of experiments and to modify established procedures. The course will also provide practice in the formal writing of experimental
procedures and findings (lab reports). Prerequisite: Chem 112A with a “C” or better; note that a grade of “C-“ (C-minus) is not acceptable. **NOTE:** This prerequisite will be strictly enforced.

**SCHEDULE OF EXPERIMENTS:**
Sufficient time is allotted for each experiment, assuming that you have adequately prepared for the procedure before coming to lab. Refer to the schedule included on the web site and herein for the dates of individual experiments and tests. The schedule may be revised -- any changes will be announced in lab and via email. Written permission to complete work in another section will not be granted if lack of preparation caused you to fall behind.

Although attendance per se is not a criterion for grading, you must attend each section, even on the few occasions that you may have completed your lab work early. There are many good reasons for this, the most compelling of which are that upcoming experiments are discussed, along with important safety guidelines, additional topics for required subjects, and we will review your quizzes or other relevant topics from organic chemistry. If you miss the discussion you may not be permitted to perform that experiment, receiving a failing grade for that item. I will try to work with you to avoid this in cases where you have a documented medical or other serious reason to be absent.

**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/.

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

**LEARNING OBJECTIVES:**
- Learn to practice safe laboratory techniques.
- Routinely perform stoichiometric calculations (limiting reagent, theoretical yield).
- Understand and be able to use the basic operations of an organic laboratory including gravity & vacuum filtration, liquid-liquid extraction, distillation, reflux, recrystallization, drying of solids and solutions, and the theories behind these techniques.
- Identify and assess the purity of organic compounds using analytical techniques like melting point, thin layer chromatography (TLC), IR (v.i.), NMR (v.i.), and gas chromatography.
- Deduce organic structure using spectroscopic methods: esp. infrared (IR) and nuclear magnetic resonance (NMR) spectroscopy; minor mention of mass spectra and ultraviolet spectra/visible (UV/vis).
- Be able to deduce hydrogen deficiency index (HDI) from a molecular formula and use this in structure determination.

For NMR:
- Understand the fundamental theory of 1-dimensional proton NMR analysis; symmetry.
- Understand the effect of structure on chemical shift and coupling constant.
- Learn to calculate chemical shifts for substituted alkanes and aromatics using tables.
- Be able to construct splitting diagrams (“trees”) and be able to measure coupling constants from an NMR spectrum.
- Be able to recognize and know how to test for exchangeable hydrogens in a molecule.
- Be aware of the regions of the NMR spectrum where various key protons are found.
- Be able to fully assign NMR spectra.

For IR:
- Be familiar with the principles behind IR spectroscopy.
- Understand the factors that influence the strength and frequency of an IR peak.
- Assign key peaks in an IR spectrum.
- Be able to determine which peaks are most diagnostic in making an assignment of structure using IR.
- Be able to record an IR spectrum.

- Develop the ability to follow a detailed procedure, and construct a flow diagram to illustrate it.
- Understand the theory behind the operations performed, as demonstrated by the ability to explain deviation from the theoretically optimum results (which is the usual case), and suggest improvements to the procedures employed.
- Understand and be able to reproduce for a related chemical system the detailed chemical mechanisms for all laboratory reactions employed.
- Learn to keep contemporaneous notes – writing down what you do and what you see directly in the lab notebook as you do it and see it, as you would in normal professional environments, in sufficient detail that another person not familiar with the particular experiment could reproduce your work. This last statement is the purpose of a notebook. It can be critical in certain situations.

NOTEBOOK: (see notebook guidelines, p. 8 herein, and aforementioned course website) All laboratory records are to be recorded in a Hayden-McNeil Brand 100-page Carbonless Duplicate Student Laboratory Notebook with consecutively numbered duplicate pages. All experimental notes are to be entered directly into the notebook (never on paper towels or other scraps of paper; this practice will be penalized) and dated. Use ballpoint pen; do not use red ink; use one column per page format, not 2 columns. If some data are rejected for some reason, neatly cross out the entry with a single line and enter a brief explanation beside it; never "write-over" any entry and never use "white-out." Do not discard or tear out a notebook page. Any material taken from other sources (such as equations, procedures or physical constants) must be referenced in the lab notebook. The notebook is to be kept up to date. The lab notebook will be checked daily, and at the end of each experiment the duplicate sheets will be removed and handed in with the lab report. The conclusion section, however, will not be submitted on notebook pages, but rather to an on-line address, www.turnitin.com, details to be provided, as well as a hard-copy as part of the lab report. (The conclusion can be in the notebook). Turnitin checks for plagiarism and compares your conclusion to every similar conclusion on the subject that has ever been submitted anywhere in the country. It does not miss anything!!

At the end of each and every working lab period it is the responsibility of the student to obtain the instructor’s signature/initials on that day’s dated notebook. It is these pages, which you actually
wrote during** lab, that are to be submitted as laboratory observations with the lab report. For each working day the conclusions are not initialed, two points will be deducted from the observations section.

**Do not write the procedure in advance in your notebook, you must record what you do and see in lab rather than filling in blanks. Two points will be deducted for writing observations in advance. NOTE: Keeping contemporaneous notes is an important course learning objective.

LABORATORY REPORTS:
Reports are written in the lab notebook before lab (prelab write-up), during lab (observations as you do the expt), and after lab (see notebook addendum handout for details). In general you should have all the preliminary work done before lab, record observations during lab, and write your conclusions outside of (or after) lab. The duplicate sheets are to be handed in stapled to the cover sheet (Lab Report Summary sheet found in Notes for Chemistry 113A purchased from Maple Press) by the beginning of the lab period on the date the report is due (refer to schedule), followed by any data and then the conclusion.

Each report should follow the format designated for that type of experiment; in this class there will be two kinds of experiments: preparative and investigative; formats for the two differ; see notebook handout. Reports must be complete, well organized and legible, especially the conclusion which is typed. The report conclusion is organized as follows: 1. introduction: a paragraph consisting of a short few sentences summarizing what the expt was about and what you will say in the rest of the conclusion; this acts as a template for the rest of the conclusion; 2. middle: a few paragraphs organized according to the conclusion intro that give appropriate details and noteworthy items for each section; for preparative expts: first discuss the preparative reaction itself, then the purification (flow chart), then the purity along with the data for all of this as support; include observations you made during the procedures, any variance from the recommended procedures, your yield, its purity, any losses (systematic NOT trivial, i.e. “...some product stuck to the flask/beaker/spatula/filter paper and therefore was lost.), suggestions for improvements; discuss any tests you did, any spectra obtained, the data and especially its interpretation; a machine records the data: YOU interpret it and give it meaning; 3. end: a few sentences summarizing the expt.

Reports are to consist of your own thoughts and be expressed in your own words (see Academic Honesty below). Any time you refer to another person's data you must make clear reference to the source (i.e., that person's name) in your lab book as well as on any spectra or chromatograms obtained from the other student. Under no circumstances are you to refer, with attribution or without, to data belonging to anyone outside of your section. Representing another persons data (of any sort, including spectra and GC traces) as being your own constitutes plagiarism and will be dealt with as such.

NOTE: You should realize that you must have certain preliminary sections of the lab report written before you will be permitted to begin the experiment. You must have the Lab Report Summary Sheet (from the Notes for Chemistry 113A) ready when submitting the preliminary sections for approval. Details are included in the notebook handout.

Late reports: Your grade for late reports will be lowered by one letter grade (e.g., A- to B-) for each lab period the report is late. There will be a more drastic late penalty in effect after the
last lab period of the semester. Reports are late if not submitted by the scheduled beginning of the lab period for which you are enrolled - if you show up late the report is late also. Report writing in lab (other than recording observations or preparing for a new experiment) is not permitted - we want to use time in the lab effectively in developing lab skills. Lab time is limited and precious: don't waste it!

EQUIPMENT:
You will be issued a lab locker and an equipment pad; you are responsible for both. If you drop at any time after these are issued you must check in both of these with the instructor in order to avoid a $10 fine in addition to charges for damaged or missing equipment. Much of the laboratory equipment is quite expensive, especially those with calibration marks or ground glass joints; be careful with it or you may receive a rather large bill. You will be charged for all supplies you check out except those returned to the service center clean and in good condition. Do not lose your equipment pad; items on it are charged to your number. Refer to the stockroom handout for details on procedures and fines. The Service Center can provide you with a list of item costs upon request.

PRODUCTS:
The preparative experiments involve chemical synthesis, the conversion of one substance (the starting material, a measured sample of which is provided) into a different organic compound (the product). The products of such preparations must be submitted for grading in a vial with a cork or clean polyethylene cap (organic liquids often attack rubber stoppers or black plastic screw caps). All products are to be labeled as follows:

NAME OF COMPOUND
% YIELD
WEIGHT
m.p. Or b.p.
STUDENT'S NAME

(Paper labels and Scotch tape are available from the service center - don't write on glass.) The weight is that of the actual contents only, not the vial; remember to tare (weigh before filling) all of your containers. The melting point and boiling point ranges are those actually observed for your sample; these will be checked for grading and a penalty will apply for misrepresented data, and possibly for any foreign material present (dirt, filter paper, cork chips, etc.). Products will also be evaluated by appearance and odor. Purity is more important than yield.

GRADING:
Letter grades will be assigned to each laboratory report (8 anticipated), as well as to the experiment quizzes (8 anticipated, none dropped), midterm exam and the final exam. Point evaluations will be used by the grader (me) primarily to give you feedback as to which aspects of the work most need improvement and what your strong points are. However, the final course grade will be determined as the weighted average of the letter grades for individual tests and reports. There is a significant penalty for late reports (see “Laboratory Reports” above).

The weighting is anticipated to be as follows: Reports 45% (7.5% for Experiments B and H and 5% for each of the others); Quizzes 10%; Midterm 15%; Final Exam 30%. Also, I reserve the right to raise the grade of any student by one third of a unit (e.g. B to B+) for consistently outstanding laboratory work, well done notebooks, proper attitude, etc.

There will be an extra credit organic unknown (Experiment H – EC) for those who turn in Report H by the fifth-to-the last lab period (4/24-25, marked with a ‡) and get the structure of the
unknown correct. This extra credit report is worth up to 0.1 grade points in the final course grade: i.e. B- to B, or B+ to A-, etc. A grade calculator will be available (on the class website, or provided by the instructor); use it to check on your progress.

POSTED MATERIALS:
Our class bulletin board is in the hall outside S-164. Note that due to limited space exam/quiz keys will remain posted only until the next exam - please make note of any answers of interest soon after posting as the material. Or we will have another choice that we can use (D2L site, yahoo group).

SERVICE CENTER:
Your instructor does not make Service Center policy. However, the Service Center is essential to the smooth operation of our already overburdened laboratory facilities. Therefore, any student who behaves in an abusive, belligerent, or confrontational manner toward the Service Center personnel shall be considered to be disrupting the class and will face academic and/or administrative sanctions according to University Policy #41301 (d) and (k).

DEPARTMENT SAFETY POLICY:
You should read the safety section of the SJSU Catalog under Chemistry Department (page 125 of current 2008/10 Catalog). Note in particular: "Failure to comply with proper procedures and prescribed safety cautions 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."

ADDITIONAL LABORATORY SAFETY INFORMATION:
Note that Chem 120CS (Chemical Safety) is a required course for all Chemistry majors and Minors for students admitted to the university on or after Fall Semester, 1988.
• A bound, indexed set of Notes for Chemistry 113A for the current semester is a required item for the course. Since experiments are frequently changed and these changes may not be immediately obvious, the use of old course notes could lead to a hazardous situation in the laboratory and is therefore not permitted. Use of a cell phone or other similar distractions in lab is prohibited; please go outside the lab to make or receive calls.
• Students must read and sign the Chemistry Department Safety Rules Handout and return it to the instructor before a locker will be issued.
• Students are required to attend the instructor's safety lecture; attendance will be taken, and a quiz given.
• Students are required to view the safety film required for the course; department policy mandates that any student who fails to do so will be dropped from the course.
• Nearly all organic compounds will burn and some, particularly volatile ones such as ether, acetone, hexane and benzene, do so explosively. Never expose such solvents to open flames. Know the location of the fire extinguisher, safety shower and emergency eyewash station. Most organic compounds are toxic; if any compound comes in contact with your skin, wash with copious amounts of water and then an appropriate neutralizing reagent such as bicarbonate for acids, or boric acid for bases. Always use the hood when possible if you work with any volatile solvents.
NOTE: Before using a Bunsen burner, FIRST Ask the lab instructor if it is safe to have an open flame; in general you won't need one; then look around you, and ask any neighbors if they are using a volatile solvents or compounds. When there is any question, use a steam bath, hot plate, or heating mantle.

- Inform the instructor promptly of any accidents, or if you are not feeling well.
- Safety glasses must be worn at all times. Unauthorized persons (friends, relatives, etc.) may not enter the lab without permission of the instructor, and they must first obtain protective eye wear. You, the student, are not permitted in the lab without eye protection.

ADDENDUM TO ALL CHEMISTRY DEPARTMENT GREENSHEETS

(Except Chem 291 Sections) Revised January 2008

CHEMICAL SAFETY – all courses
Chem 120S is a required course for all chemistry majors and minors and a prerequisite for all Chem 180/298 research.

EMERGENCIES AND EVACUATIONS – all courses
If you hear a continuously sounding alarm, or are told to evacuate by Emergency Coordinators (colored badge identification), walk quickly to the nearest stairway (end of each hall). Take your personal belongings, as you may not be allowed to immediately return. Follow instructions of Emergency Coordinators. Be quiet so you can hear. Once outside, move away from the building. Do not return to the building unless the Police or Emergency Coordinators announce that you may.

DISABLED STUDENTS – all courses
Campus policy in compliance with the 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 requesting accommodations must register with DRC to establish a record of their disability."

ACADEMIC INTEGRITY STATEMENT – all courses (from the Office of Student Conduct and Ethical Development):
"Your own commitment to learning, as evidenced by your enrollment at San José State University, and the University’s Academic Integrity Policy requires you to be honest in all your academic course work. Faculty members 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/judicial_affairs/index.html

LABORATORY SAFETY – all laboratory courses
You should read the safety section of the SJSU Catalog under Chemistry Department (page 125 in the 2008/10 Catalog). Note in particular: “Failure to comply with proper procedures and prescribed safety cautions 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.”
EXPERIMENTAL LAB NOTEBOOK GUIDELINES
also see: http://www.chemistry.sjsu.edu/straus/visioche.htm

-the notebook has a title page with your name, course #, instructor name(s), general references; also a table of contents listing the experiments with starting page numbers.

-each expt should have:
  -title, -date started, -references with specific page numbers, purpose, & conclusion; the main parts of the expt, like a table of contents for the expt; then organize the expt using those main parts as sub-headings.

-each expt will also have where appropriate: a main reaction, a mechanism, a purification flow chart, & a table of relevant properties and amounts used or produced for all reagents and products. A list of equipment or an apparatus sketch may also be useful.

-Include at the bottom of each page: 'cont'd on page xx', and at the top of page xx: 'cont'd from page yy'

-all data, spectra, chromatograms, etc., are permanently attached (staple, glue, weld). A sketch or drawing of the data is also acceptable.

Organize the expt according to your summary (noted above) by what you will do, followed by what you actually did.

At end of each lab period: we both sign or initial it; at the end of expt or where instructor witnesses it, we both sign. If you stop in the middle of a page then start up the same expt again the next lab, just put in the new date and continue writing. Use only one expt per page.

use ink only, not red ink. if you make a mistake: use ONE line to cross it out: no white out, erasures, or tearing out notebook pages.

Your notebook should go around the lab with you, when you measure something, weigh something, take an IR, mp or GC; it should be at your bench/hood to record things as you do them. ALWAYS tare (pre-weigh) all your containers, flasks, beakers, buchner funnels, even filter papers; it will save you lots of effort later on.

YIELD IS LESS IMPORTANT: PURITY IS PARAMOUNT!!
**Laboratory Schedule**

Chem 113A Spring 2013 MW Labs

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Synthesis of Aspirin</td>
<td>2/6</td>
</tr>
<tr>
<td>B Analysis of Spartacetin (Part I)</td>
<td></td>
</tr>
<tr>
<td>B Recrystallization (Part II)#</td>
<td>2/25</td>
</tr>
<tr>
<td>C Introduction to IR and NMR</td>
<td>3/11</td>
</tr>
<tr>
<td>D Unknown Alcohols</td>
<td>4/3</td>
</tr>
<tr>
<td>E Alcohol Esterification</td>
<td>4/17</td>
</tr>
<tr>
<td>F Unknown Ketone</td>
<td>5/1</td>
</tr>
<tr>
<td>G Oil of Cloves</td>
<td>5/13</td>
</tr>
<tr>
<td>H Identification of an Unknown</td>
<td>5/13</td>
</tr>
</tbody>
</table>

Monday

- 1/23 Check-in, Safety Lecture
- 1/28 Begin A
- 2/4 Complete A, Begin B
- 2/11 Continue B
- 2/18 Complete B,
- Begin C (First IR Lecture)
- Distribute Unknown "H"
- 2/25 Quiz B (Part II), Continue C
- 3/4 Begin D
- 3/11 Quiz C, Continue D
- 3/18 MID-TERM EXAM (A-D), Complete D
- 3/25 SPRING BREAK
- 4/1 Chavez Day, NO CLASS
- 4/8 Complete E
- 4/15 Continue F
- 4/22 Complete F
- 4/29 Continue G
- 5/6 Continue G
- 5/13 Quiz G, Check-Out

Wednesday

- 1/30 Continue A
- 2/6 Quiz A, Continue B
- 2/13 Quiz B (Part I), Continue B
- 2/20 Continue C
- (First NMR Lecture)
- 2/27 Complete C
- 3/6 Continue D
- 3/13 Continue D
- 3/20 Begin E**
- 3/27 SPRING BREAK
- 4/3 Quiz D, Continue E
- 4/10 Begin F
- 4/17 Quiz E, Continue F
- 4/24 Begin G‡

* Turn in complete report H to get extra credit sample to get extra credit sample

** By this point you should be making good progress on Experiment H, work on it whenever you have time.

* The schedule is subject to modification during the semester; advance notice will be given for any changes.

‡ The second report includes both parts of Exp. B