SAN JOSE STATE UNIVERSITY
CHEMISTRY 113A
ORGANIC CHEMISTRY LABORATORY – Fall 2013

Instructor: Dr. Sreenivasan Balasubramanian (Bala)
Lab Hours: Section 2, MW 2.30PM – 5.20PM    Location: SCI-154
Office Hours: SCI 140, MW 2.00PM – 2.30PM, or by appointment through Email
Email: bala@science.sjsu.edu    Phone: (408) 924 4997

PREREQUISITE:
CHEM 112A (with a grade of "C" or better; "C-" not accepted).

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 Fall 2006 (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

On the first day of lab, you will receive the following items from the instructor and service center

From Instructor:
   Locker Inventory Card
   Department Safety Sheet
   Drop Policy (green sheet addendum)

From Service Center (S-150):
   Equipment Pad
   Service Center Procedure Sheet/Price List

Note:

Test copies and keys from a previous semester are included on the web site.

COURSE WEB SITE:
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.

http://www.chemistry.sjsu.edu/straus/visioche.htm
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. Prerequisite: Chem 112A with a “C” or better; “C-” not accepted. This prerequisite will be 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 for the dates of individual experiments and tests. The schedule may be revised -- any changes will be announced in lab. Written permission to complete work in another section of Chem 113A will not be granted if lack of preparation caused you to fall behind. Also, alternate attendance (working in another section) is not an option without a documented medical emergency or similarly urgent circumstance. There is a form available in the service center for obtaining dual permission (from your instructor and the host instructor) to do so in these rare cases.

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 is that coming experiments are discussed, along with important safety guidelines. If you miss the discussion you may not be permitted to perform that experiment, receiving a fail for that item. I will try to work with you to avoid this in cases where you have a documented medical or other serious and compelling 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.
LEARNING OBJECTIVES:

- Learn to practice safe laboratory techniques.
- Routinely perform stoichiometric calculations (limiting reagent, theoretical yield).
- Understand and implement the basic operations used in the organic laboratory including gravity and vacuum filtration, liquid-liquid extraction, distillation, reflux, drying of solids and solutions.
- Identify and assess the purity of organic compounds using melting point, thin layer chromatography, and gas chromatography.
- Deduce organic structure using spectroscopic methods – in particular infrared (IR) and nuclear magnetic resonance (NMR) spectroscopy.
- Be able to deduce hydrogen deficiency index from molecular formula and use this in structure deduction.
  - Understand the fundamental theory of 1-dimensional proton NMR analysis.
  - Understand the effect of structure on chemical shift and coupling constant.
  - Learn to calculate chemical shifts for substituted alkanes and aromatics.
  - 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 will resonate.
  - Be able to fully assign NMR spectra.
  - Be familiar with the principles behind the phenomenon if IR.
  - 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.
- Learn to keep contemporaneous notes – writing down what you do and see directly in the lab notebook, as you would in normal professional environments, in sufficient detail that another person not familiar with the particular experiment could reproduce your work.

NOTEBOOK:
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) and dated. Use ballpoint pen; do not use red ink. 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.
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 periodically, and at the end of each experiment the duplicate sheets will be removed and handed in with the lab report. The conclusions section, however, will not be submitted on notebook pages, but rather to an on-line address (www.turnitin.com; details to be provided). You need to attach the online submission receipt along with the lab report.

OBSERVATION NOTES

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, during and after lab (see 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 (after) lab. The duplicate sheets are to be handed in stapled to a cover sheet (Lab Report Summary) by the beginning of the lab period on the date the report is due (refer to schedule).

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 Format handout. Reports must be complete, well organized and legible.

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 person’s data (of any sort, including spectra and GC traces) as being your own constitutes plagiarism and will be dealt with as such.

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 ready when submitting the preliminary sections for approval. Details are included in the Notebook Format handout.
Late reports: Your grade for late reports will be lowered by one letter grade (e.g., A- to B-) for the 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.

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; 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:

<table>
<thead>
<tr>
<th>NAME OF COMPOUND</th>
<th>% YIELD</th>
<th>WEIGHT</th>
<th>m.p. or b.p.</th>
<th>STUDENT'S NAME</th>
</tr>
</thead>
</table>

(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. 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.
GRADING

Lab Reports
A 50-point scale will be used to evaluate each lab report (nine anticipated). However, for two lab reports (B and H), a 75-point scale will be used. For each lab report, in addition to a score, a letter grade based on a 20 point scale (see below) will be given. There is a significant penalty for late reports (see “Laboratory Reports” above).

Quizzes
A 20-point scale will be used for quizzes (eight or nine anticipated).

Mid-term and final exam
Midterm exam and final exam will be evaluated on a 100-point scale. In addition to a score, a letter grade based on a 20 point scale (see below) will be given.

Final grade
The final course grade will be determined as the weighted average of the individual tests and reports. 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.

The final letter grade will be determined on the basis of a 20-point scale as follows.

\[
\begin{array}{cccccc}
\text{A+} & 19.6-20.0 & \text{B+} & 16.6-17.5 & \text{C+} & 13.6-14.5 & \text{D+} & 10.6-11.5 \\
\text{A} & 18.6-19.5 & \text{B} & 15.6-16.5 & \text{C} & 12.6-13.5 & \text{D} & 9.6-10.5 \\
\text{A-} & 17.6-18.5 & \text{B-} & 14.6-15.5 & \text{C-} & 11.6-12.5 & \text{D-} & 8.6-9.5 \\
\end{array}
\]

F (failure): 8.5 and less

Experiment H – extra credit work
There will be an extra credit organic unknown (Experiment H – EC) for those who turn in report H by the sixth-to-the last lab period and get the structure of the unknown correct. This extra credit report is worth up to 0.5 grade points in the final course grade (20 – point scale).

Makeup Exams
Makeup exams will not be offered. You may only take the exam in the section for which you are officially enrolled. If you believe there has been a grading error, please bring it to my attention within two calendar weeks after the exam has been returned; I will not consider any grading issue after the two calendar weeks period.

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.
POSTED MATERIALS:

Check the following website for posted materials: www.chemistry.sjsu.edu/bala

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).

ACADEMIC INTEGRITY STATEMENT (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/student_conduct.

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."

DEPARTMENT SAFETY POLICY:

1) You should read the safety section of the SJSU Catalog under Chemistry Department (Page130 of current 2010/11 Catalog). Note in particular: "Failure to comply with proper procedures and prescribed safety cautions shall subject the student to disciplinary action. 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.
- 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.
- 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, combust 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.
- Inform the instructor promptly of any accidents.
- 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 eyewear.

CELL PHONE USAGE

Students are not allowed to use cell phone when the lab work is in progress. However, if time permits, students can go outside the lab to use the cell phone.

PERSONAL BELONGINGS

You are fully responsible in taking care of your belongings in the lab. Make sure that you securely store your bag, laptop, and other electronic items when you are working in the lab. You are not permitted to use your laptop in the area where you perform your experiments.

CHEMICAL SAFETY:

Chem 120S is a required course for all chemistry majors and minors and a prerequisite for all Chem 180/298 research.
### Laboratory Schedule*

**Chem 113A**  
**Fall 2013**  
**MW Labs**

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>9/9</td>
</tr>
<tr>
<td>B</td>
<td>9/25</td>
</tr>
<tr>
<td>C</td>
<td>10/7</td>
</tr>
<tr>
<td>D</td>
<td>10/21</td>
</tr>
<tr>
<td>E</td>
<td>11/12</td>
</tr>
<tr>
<td>F</td>
<td>11/20</td>
</tr>
<tr>
<td>G</td>
<td>12/9</td>
</tr>
<tr>
<td>H</td>
<td>12/9</td>
</tr>
</tbody>
</table>

**Monday**  
**Wednesday**

- 8/21  
  - Check-in, Safety Lecture

- 8/26  
  - Begin A

- 8/28  
  - Continue A

- 9/2  
  - Labor Day – No Class

- 9/4  
  - Complete A, Begin B

- 9/9  
  - Quiz A, Continue B

- 9/11  
  - Continue B

- 9/16  
  - Quiz B (Part I), Continue B

- 9/18  
  - Complete B, Begin C (First IR Lecture)  
  - Distribute Unknown "H"

- 9/23  
  - Continue C (First NMR Lecture)

- 9/25  
  - Quiz B (Part II), Complete C

- 9/30  
  - Begin D

- 10/2  
  - Continue D

- 10/7  
  - Quiz C, Continue D

- 10/9  
  - Continue D**

- 10/14  
  - MID-TERM EXAM (A-D), Complete D

- 10/16  
  - Begin E
<table>
<thead>
<tr>
<th>Monday</th>
<th>Wednesday</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/21 Quiz D, Continue E</td>
<td>10/23 Continue E</td>
</tr>
<tr>
<td>10/28 Complete E</td>
<td>10/30 Begin F</td>
</tr>
<tr>
<td>11/4 Continue F</td>
<td>11/6 Continue F</td>
</tr>
<tr>
<td>11/11 Veteran’s Day – No Class</td>
<td>11/13 Quiz E, Complete F</td>
</tr>
<tr>
<td>11/18 Begin G</td>
<td>11/20 Quiz F, Continue G</td>
</tr>
<tr>
<td></td>
<td>* Turn in complete report H</td>
</tr>
<tr>
<td></td>
<td>to get extra credit sample</td>
</tr>
<tr>
<td>11/25 Continue G</td>
<td>11/26 Continue G‡</td>
</tr>
<tr>
<td>12/2 Continue G</td>
<td>12/4 Complete G, Complete H</td>
</tr>
<tr>
<td>12/9 Quiz G, Check-Out</td>
<td></td>
</tr>
</tbody>
</table>

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

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

# The second report includes both parts of Exp. B.

‡ Evening lab does not meet Wednesday 11/28.

**Final Exam: Friday, December 13, 2013, 12:15 PM – 2:30 PM.**