**Chemistry 129A Fall 2018 Syllabus**

Instructor and Contact Information:

Instructor:

Lab Section:

Office:

Office Hours:

E-Mail:

**Lab Coordinator:** Dr. Santanu Maitra; email: [smaitra@mail.fresnostate.edu](mailto:smaitra@mail.fresnostate.edu); office: S 246; office hours: MW 12:30 – 1:30 pm.

**CHEM 129A Lab Sections:**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 129A | 5 | 75086 | 2 | Lab | 09:00A-11:50A | TuTh | S | 370 | Munshi K |
| 129A | 7 | 74936 | 2 | Lab | 08:00A-10:50A | MW | S | 370 | Muchalski H |
| 129A | 8 | 74937 | 2 | Lab | 09:00A-11:50A | MW | S | 372 | Chen M |
| 129A | 10 | 75335 | 2 | Lab | 09:00A-11:50A | TuTh | S | 372 | Tamras S |
| 129A | 12 | 75708 | 2 | Lab | 01:00P-03:50P | TuTh | S | 370 | Ciula J |
| 129A | 16 | 75087 | 2 | Lab | 12:00P-02:50P | MW | S | 370 | Muchalski H |
| 129A | 17 | 75692 | 2 | Lab | 01:00P-03:50P | MW | S | 372 | Tamras S |
| 129A | 18 | 76133 | 2 | Lab | 01:00P-03:50P | TuTh | S | 372 | Tamras S |

**Required Course Materials:**

1) Pavia, Donald L., et al., A Microscale Approach to Organic Laboratory Techniques, 6th Edition, Thompson/Brooks Cole; It is acceptable to buy an earlier edition of the textbook by the same authors, which is usually available at a reduced price from Amazon or other online sources. If you want to consider an older edition, make sure its focus is microscale experiments/techniques - this will be evident from the title of the textbook. (these same authors have versions that focus on semi-micro and larger scale techniques/experiments). Please check with your instructor if you want to purchase an older edition.; 2) approved lab safety glasses or goggles; 3) Blue Book or bound laboratory notebook (pages must be bound; no binders or spiral notebooks). Please check with your instructor for their preference.

**Course Prerequisite**: CHEM 8 or CHEM 128A with a grade of C or better. CHEM 128A can be taken concurrently.

**Introduction and Course Description:**

Chemistry 129A, Introductory Organic Chemistry Laboratory, is a two unit laboratory course meeting in either Science 372 or S 370. This is the first semester of a one year laboratory course in organic chemistry. As such, it is primarily concerned with introducing the tools and techniques that chemists use to investigate the nature of organic compounds. Some of these techniques are the same or similar to those familiar to you from general chemistry: you probably already know how to use an analytical balance, perform a titration with a burette, separate solids from liquids by filtration or centrifugation, collect gases by displacement of water, and perform simple qualitative tests with test tubes and droppers. To this basic list we will add liquid/liquid and liquid/solid extractions, crystallization, TLC, column and gas chromatography, simple and fractional distillations, melting point and boiling point determinations, polarimetry, and infrared spectroscopy. Because some of the experiments are performed using very small amounts of material (microscale techniques), some of the familiar techniques are specially modified. Students who successfully complete 129A generally continue during the next semester or later with Chemistry 129B, the intermediate level laboratory course. That course introduces additional techniques and tools, strengthening the student’s ability to begin independent research. Some students then continue with Chemistry 190, undergraduate research or independent study.

**Primary Learning Outcomes:**

Students who successfully complete Chemistry 129A should be able to:

* plan laboratory experiments based upon a typical textbook write-up.
* keep accurate and informative laboratory records that would allow another person of similar ability level to repeat the experiment with the same results.
* obtain meaningful experimental results and reasonable amounts of products.
* analyze the results of an experiment and be able to suggest improvements.
* answer questions based on text material or laboratory experiences.
* carry out basic organic techniques, including extraction, crystallization, distillation, and chromatography.
* measure physical properties of organic compounds including melting and boiling points, refractive index, optical rotation, IR spectra and gas chromatograms.
* understand how to work safely in the laboratory, including the disposal of chemical wastes.

**Experiments:** See the Chem 129A Lab Schedule (pp. 9 of this syllabus). You are responsible for reading the experiment before coming to class and doing the pre-lab write-up. Pre-lab lectures for each experiment will be given that cover the basic techniques, including experimental design and the purpose of each experiment. The relevant techniques for each experiment are noted in the lab-text at the beginning of each experiment. You are responsible for this material/readings so that you can understand what you will be doing in lab and how best to do it.

**Attendance:** Since this is a lab course, **attendance is mandatory**. You must complete all experiments in order to obtain a passing grade in the course. Since important information about each experiment (including safety information) is provided at the beginning of the lab period it is important to be on-time. *Being late for lab will contribute to lowering your final point total which is the basis of your final grade.*  You may not be allowed to begin an experiment if you miss the pre-lab lecture.

## Important Attendance Note: If you cannot make a lab you must notify your instructor before the lab period explaining why you have to miss the lab. In the case of an emergency, contact your instructor as soon as possible. If your request is approved you are still required to document the reason for missing the lab, and will be expected to make the lab up and complete the assigned work. *If the above conditions are not met, then a grade of 0 will be given for the missed lab.*

**Lab Schedule:** The lab schedule is subject to change by the instructor in the event of extenuating circumstances.

**Lab Notebook:** You are required to write Pre-Lab, In-Lab, and Post-Lab notes for each experiment that you do. You must keep your lab book current and up-to-date; experiments should not be rewritten afterwards to improve neatness. *Instructions for maintaining your laboratory notebooks are provided on page 5 of this syllabus- read it carefully* (Mandatory Formatting for Lab Notebooks Handout)*.* Pre-lab, in-lab and post-lab notes are subject to evaluation at any time. Your instructor may spot-check your lab-book before you begin an experiment. You will not be allowed to begin an experiment unless your pre-lab is completed. Lab notebooks will be collected for grading at the end of the semester and one or more times during the semester as specified in the lab schedule. Your instructor will inform you about her/his preference over Blue Books or Hard Bound Note Book.

**Results and Unknowns:** For experiments involving synthesis or unknowns, products/results should be ready for submission to your instructor one week after the experiment is completed (based on the lab schedule). Lab write-ups should also be completed by this time. When requested by your instructor, samples should be submitted in a labeled sample vial. Make sure your vial is correctly labeled so that the Chemistry Department can properly (legally) dispose of it at the end of the semester*.*  *Vial labels should include the chemical’s name, the date it was prepared (mo/yr) and your name.* Do not write directly on the vial (use a label); do not use conical vials or round bottom flasks for storage since these are needed for experimental work. Sample vials should be in your lab drawer, but additional vials in a variety of sizes are available for checkout from the glassware stockroom or your instructor.

**Quizzes:** There will be four (4) lab quizzes—dates are listed in the lab schedule. Quizzes will be approximately 30 minutes in length and will include questions that test your understanding of the lab techniques and your experimental work. These quizzes will be based on material covered in the pre-lab lectures and in the assigned HW questions and reading assignments.

**Safety Quiz:** You must pass the Safety Quiz to remain in the class. You can take the quiz up to 3 times. The quiz is based upon the information on safety sheet, your instructor’s lab lecture on safety, and Technique 1 (Safety) in the lab textbook. You are strongly encouraged to read the safety related notes, abide by the guidelines ALL THE TIME to keep the lab, lab occupants, and everyone else in the department safe.

**Lab Practicals:** These are the last two experiments for the semester (see Lab Schedule). You will be given a procedure (handout) at the beginning of the Practical session. Your grade for these Practicals will be based on the time required for completion of each procedure, the yield and purity of your product, your actual performance in the lab, and your experimental write-up.

**Homework:** Homework problems will normally be assigned for each experiment. The problems will either be posted in a *Homework Assignment* Folder on your class Blackboard page, or directly provided to you by your lab instructor. All homework is due one week after the schedule completion of the experiment. Although the HW is only a relatively small percentage of your class grade, it is important to help you prepare for the lab quizzes and to help you better understand the technical aspects and theory behind the experiments.

**Grading:**

Lab Notebook/Blue Book, Home Work, Results …… 50%

Quizzes 1-4………………………………………….. 30% (7.5%/quiz)

Lab Practicals……………………….. ……………… 10%

Instructor’s Evaluation………………………………. 10%

Total ………………………………………………… 100%

Quizzes and HW assignments are normally curved with the curve dependent on overall class performance. In the past, the grading scale followed a pattern close to the following (note that curves so vary somewhat from semester to semester). A = 85-100, B 75-84, C 65-74; D 50-64, F <50.

**Instructor’s Evaluation**: The instructor’s evaluation can make a significant difference in your final course grade. This evaluation will be based on the following factors: arriving in lab on time, being prepared for lab, appropriate participation in class discussions, observance of lab safety rules, laboratory technique, efficient use of lab time (completing labs on time), working independently, initiative and work-ethic, and your ability to work well with others.

**Lab Notebook Grading**: Your lab notebook is graded based on the criteria discussed in the section on Mandatory Formatting for Lab Notebooks (p. 6 of this syllabus).

**Results**: Full credit for experimental results means that a pure product of reasonable yield was submitted by the due date in a properly labeled vial. Points are deducted based on poor yield, poor purity, incorrect labeling, late submission, not wearing safety glasses (one warning then no credit for the experiment), not following safety rules (no credit for the experiment). Unknown grades are also based on accuracy of your results and the quality of your discussion and analysis of your data. At the instructor’s discretion, experiments may be weighted differently based on the time required to obtain products/results—e.g., an experiment that requires more time to complete, or requires significantly more time out-of-class will normally be weighted more heavily than one that requires less time and effort.

In some experiments you will work in pairs or small groups. In such cases each student is expected to participate fully in the project. Although each student is responsible for their own laboratory work, notes and reports, it is permissible to compare results and discuss the significance of these results with other students.

**Blackboard**: Your lab instructor may use *Blackboard*, a web-based class management and communication tool to post supportive class materials including announcements, grades, etc.

**University Policies:**

**Cheating and Plagiarism**: "Cheating is the actual or attempted practice of fraudulent or deceptive acts for the purpose of improving one's grade or obtaining course credit; such acts also include assisting another student to do so. Typically, such acts occur in relation to examinations. However, it is the intent of this definition that the term 'cheating' not be limited to examination situations only, but that it include any and all actions by a student that are intended to gain an unearned academic advantage by fraudulent or deceptive means. Plagiarism is a specific form of cheating which consists of the misuse of the published and/or unpublished works of others by misrepresenting the material (i.e., their intellectual property) so used as one's own work." Penalties for cheating and plagiarism range from a 0 or F on a particular assignment, through an F for the course, to expulsion from the university. For more information on the University’s policy regarding cheating and plagiarism, refer to the Schedule of Courses (Legal Notices on Cheating and Plagiarism) or the University Catalog (Policies and Regulations)

**Disruptive Classroom Behavior**: "The classroom is a special environment in which students and faculty come together to promote learning and growth. It is essential to this learning environment that respect for the rights of others seeking to learn, respect for the professionalism of the instructor, and the general goals of academic freedom are maintained. Differences of viewpoint or concerns should be expressed in terms which are supportive of the learning process, creating an environment in which students and faculty may learn to reason with clarity and compassion, to share of themselves without losing their identities, and to develop and understanding of the community in which they live. Student conduct which disrupts the learning process shall not be tolerated and may lead to disciplinary action and/or removal from class."

**Students with Disabilities**: If you have a disability that will affect your performance in this course, please let me know so accommodations can be made. Students with disabilities will receive reasonable accommodation for learning and evaluation. For more information, contact Services to Students with Disabilities in the Madden Library 1049 (278-2811).

**Computers**: "At California State University, Fresno, computers and communications links to remote resources are recognized as being integral to the education and research experience. Every student is required to have his/her own computer or have other personal access to a workstation (including a modem and a printer) with all the recommended software. The minimum and recommended standards for the workstations and software, which may vary by academic major, are updated periodically and are available from Information Technology Services or the University Bookstore. In the curriculum and class assignments, students are presumed to have 24-hour access to a computer workstation and the necessary communication links to the University's information resources."

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**Mandatory Format for Laboratory Notebook**

**I. YOUR LABORATORY NOTEBOOK**

A. Since your lab notebook is the primary record of your experimental work, it has to be written in a hard-bound notebook. Spiral and three-ring binders are NOT acceptable.

B. All entries must be made DIRECTLY in your lab notebook, i.e. data recorded on scraps of paper and written in pencil are not acceptable. Note: entries must be handwritten in pen (nottyped). No credit for typed content.

C. The notebook should begin with a "Table of Contents" (leave 1-2 pages for this at the beginning), and the remaining pages should be numbered sequentially (front and back of each page); The Table of Contents should list the name and number of the experiment, such as “Synthesis of Acetaminophen,” and not just the number of the experiment.

D. Your lab notebook should be written with accuracy and completeness. It must be organized and legible, but does not need to be a work of art.

E. Your lab notebook should be an ongoing written record of what you do and have done in lab. Note: experiments should **not** be rewritten afterwards to improve neatness. No credit for rewritten work.

F. Your lab notebook needs to be written in three steps: Pre-Lab, In-lab, and Post-Lab. It should contain the following categories for each experiment that you perform in the lab.

**PRE-LAB: TO BE DONE IN YOUR NOTEBOOK BEFORE YOU COME TO THE LAB**

NOTE: You will not be allowed to begin an experiment if you have not prepared the Pre-Lab properly. Also, your primary source of instructions/procedural steps will be your Pre-Lab notes. You will not be allowed to use your lab text unless otherwise instructed. So, spend the time to write sufficient Pre-Lab notes in order to perform a given experiment in the allotted lab time. Follow the format given below.

1) Date

2) Experiment's Number & Title

3) **Introduction**

Provide a brief introduction about the "reason or purpose" for performing the experiment. You may include a brief summary of the reaction mechanism and/or techniques that you will be learning by performing the experiment. If you are making (synthesizing) a new compound, you must also include a BALANCED CHEMICAL EQUATION somewhere in this introductory section which describes the synthesis (you can find the balanced equations in the introductory material to the experiment in the lab textbook).

4) **Table of Necessary Chemicals & Equipment:** Include the names and formulas of all reagents and solvents, relevant physical properties such as molecular mass, mp, bp, density, specific rotation, etc.). You can get this information in our lab text, handbooks (CRC, Merck, etc), or online at [www.chemspyder.com](http://www.chemspyder.com) or [www.sigmaaldrich.com](http://www.sigmaaldrich.com), etc. MSDS sheets are available for most commercially available organic chemicals at <http://hazard.com/msds> or [www.sigmaldrich.com](http://www.sigmaldrich.com), or elsewhere on the internet.

**Safety Notes**: Below your Table of Reagents, summarize any important safety information noted in the lab textbook for the chemicals that you will be handling in the experiment (e.g., special handling and disposal methods, toxic properties, flammability, etc.). This information is normally available in the lab textbook. Additional safety information about the chemicals that you will be working with can be found on the MSDS sheets for those chemicals.

5) **Experimental Procedure & Observations**

Write an experimental outline (with numbered steps) in sufficient detail so that the

experiment could be done without reference to your lab manual. Here is a format that has worked well in the past. Divide the "Procedure" page into two columns. The first column is for the Procedure Outline that you take from the lab manual, and the second column is for writing your Observations as you perform the experiment in the lab - that is, the "In-Lab" part. For example:

Procedure Outline (Pre-Lab) Observations (In-Lab)

1. Carefully mix 2 mL of conc. sulfuric acid 1. White smoke was observed with 2 with 2 mL of conc. nitric acid in a small as the two acids were mixed.

flask

2. Add 1.5 mL of chlorobenzene dropwise to 2. After the addition was complete, the mixture and shake well. two distinct layers were noticeable.

3. etc. 3. etc.

As you have noticed, numbering the steps in both columns provides for an easy way of cross-indexing a given procedural item with its corresponding observation. It should be obvious that if no special observations are made, you should place a "check mark" or write "done" in the "Observations" column.

The actual quantities of all reagents must be recorded in the "Observations" column. For example, if the procedure calls for adding between 5 to 7 grams of a solid, you should write in the "Observations" column the actual amount that you weighed and added (for example 6.35 g). Also, the actual amount of a product, as well as its color and physical appearance, etc., should also be recorded in this column.

Remember: organic chemistry is an experimental science. Therefore, all the minute details that you might think of as unimportant in any given experiment, may actually be significant to your understanding of that experiment, and, later, in your explanation of the results. That is why your observations, and proper recording of them, are crucial in having a successful learning and lab experience.

**IN-LAB: TO BE DONE IN YOUR NOTEBOOK DURING THE LAB SESSION**

This was taken care of above in the "Observations" column and does not require further explanation.

Note: If there is a change in the procedure when you arrive in lab, that change(s) should be noted in your lab notebook. You can write “omit” and cross out a part(s) that you did not have to do, and/or add a procedure(s) if you did something in lab that you did not plan on in your pre-lab write-up.

**POST-LAB: TO BE DONE IN YOUR NOTEBOOK AFTER COMPLETING THE EXPERIMENT**

In this section of your lab notebook, you evaluate and interpret your experimental results. This should include the following subsections (the numbering sequence below follows that in the Pre-Lab section above):

6) **Calculation of Percent Yield (for synthesis experiments only)**

Show your calculation of the theoretical (expected) yield as follows:

First, you need to figure out what the limiting reagent (reactant) is in your experiment based on the stoichiometric ratios among the reactants. You can obtain this ratio using the coefficients of the reactants in the balanced chemical equation which you wrote in the Introduction section (Pre-Lab Item #3).

Second, you must CLEARLY show the following conversions: grams limiting reactant ->moles limiting reactant - > moles product -> grams product

Third, calculate percent yield as:

% Yield = Actual yield of product x 100

Theoretical yield

7) **Summary & Conclusions**

Summarize your results. If a significant amount of data was collected summarize it in table form. Attach (staple or paste) any graphs that you obtained (i.e., IR or NMR spectra). Always label graphs clearly so it is easy to tell what they refer to. It is important to write up a summary of your work as soon as possible after finishing an experiment, drawing conclusions that are supported by your observations and results. Briefly discuss your results and how your data support your conclusions; interpret key peaks in the spectra you collected. Where appropriate, discuss possible sources of error and provide suggestion for future experiments.

Cite any books or other reference sources other than the textbook that you may have used in the experiment.

**Chem 129A, Fall 2017 Lab Schedule**

This schedule is subject to change by the instructor in the event of extenuating circumstances. In addition to the assigned reading in the schedule, students are responsible for reading the Technique chapters related to each experiment. These techniques are listed in the introduction to each experiment. Your instructor may modify these readings to focus on the most relevant parts of each technique.

|  |  |
| --- | --- |
| **Week of** | **Topic** |
| Aug. 20 | Thursday Lab Meets --- Attendance (rosters) |
| Aug. 27 | **M/Tu**:Introduction, rosters, class policies, lab books, safety  *Assigned reading: laboratory safety (all labs), pp. 590 – 608 (Pavia) and Experiment 1: Introduction to Microscale Laboratory (pp. 2 – 11.)*  **W/Th**: Locker/lab check-in; Safety Sheets (Handout); exercises 1A and 2 |
| Sep. 3 | **M/Tu**: **No Lab Labor Day Holiday**  **W/Th**: **Safety Quiz\***; Expt. 2: Solubility, Parts A-E |
| Sep. 10 | **M/Tu**: Finish expt. 2; Expt. 3A-3C: Crystallization  **W/Th**: Finish expt. 3A-3C |
| Sep. 17 | **M/Tu**: Expt. 4A, 4C, 4D: Extraction  **W/Th**:Finish expt. 4A, 4C, 4D; (all labs through expt. 3 should be complete as well as the pre-lab and observations and results for expt. 4. Follow the mandatory guidelines for lab books in class syllabus) |
| Sep. 24 | **M/Tu**: **Quiz 1** (safety, expts. 2,3,4); Expt. 6A, 6B and 6D Chromatography  **W/Th**: Finish Expt. 6 |
| Oct. 1 | **M/Tu**: Expt. 8A and 8B: Simple and Fractional Distillations and GC Analysis  **W/Th**: Finish expt. 8A and 8B. *Assigned Reading: IR Spectroscopy – Technique 25, (Pavia)* |
| Oct. 8 | **M/Tu**:Chem Draw Tutorials and Molecular Modeling (Handout) – students work in pairs. Complete outside of class if necessary. (laptop/tablet required for this exercise - download ChemDraw at: <http://sitelicense.cambridgesoft.com/sitelicense.cfm?sid=2792>  ChemDraw is available to everyone with a @[mail.fresnostate.edu](http://mail.fresnostate.edu/) email address.  **W/Th**: Expt. 15A: Steam Distillation of Eugenol (use 2 g of cloves and 50 mL rbf) |
| Oct. 15 | **M/Tu**: **Quiz 2** (expts. 6,8); Finish expt. 15A: Steam Distillation; IR of eugenol sample  **W/Th**: Expt. 11B: Synthesis of Acetaminophen |
| Oct. 22 | **M/Tu**: Finish Expt. 11B; IR of Acetaminophen  **W/Th**: Expt. 14B: Synthesis of Banana Oil |
| Oct. 29 | **M/Tu**: Finish expt. 14B; IR of banana oil  **W/Th**: Expts. 23B & 23D: SN2 and SN1 Reactions. |
| Nov. 5 | **M/Tu**: Exp. 23B and D cont’d  **W/Th**: Finish 23B and 23D; IR of *n*-Butyl bromide and *t*-Pentyl chloride *(****Note: Before leaving lab on the second period of the week, all students should clean and dry the necessary glassware in preparation for expt. 35 & 35B.****)* |
| Nov. 12 | **M/Tu**: **No Lab Veteran’s Day Holiday**  **W/Th**: **Quiz 3** (IR,15A,11B,14B)**;** Expt. 35/35B: Grignard Reagent: Synthesis of Benzoic Acid |
| Nov. 19 | **M/Tu**: Continue 35/35B  **W/Th**: **No lab---Thanksgiving Break** |
| Nov. 26 | **M/Tu**: Finish expt. 35/35B; IR of Benzoic acid  **W/Th**: Finish all experiments, spectroscopy, cleaning (prior to Practicals) |
| Dec. 3 | **M/Tu**: Lab Practical #1: Synthesis of a Solid (Blue Book required)  **W/Th**: Lab Practical #2: Synthesis of a Liquid (Blue Book required) |
| Dec. 10 | **M/Tu**: **Quiz 4**: (expt. 23,35); lab check-out; **completed Blue Books/lab books due**  **Th/Fri**: Faculty Consultation Days |

\*Although the safety quiz score does not affect your final lab grade, you must pass the safety quiz in order to continue to work in the Chem 129A lab. The quiz may be retaken up to three times. The Safety Quiz is based on Technique 1 (Pavia), the CSUF Chemistry Department Laboratory Safety Rules, and the safety information presented to you by your lab instructor.