

Chemistry 146A
Advanced Laboratory in Organic Chemistry
Fall 2017
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This manual is the collaborative effort of the organic chemistry faculty Caitlin Binder, Rebecca Braslau, and Daniel Palleros with the invaluable help of Chris Murphy and Chris Bailey.

CHEM 146A – Advanced Organic Chemistry Lab Schedule

Arrive on time and dress appropriately for every lab meeting, even if no experiment will be performed that day. Bring the lab manual and notebook to every lab.

	Tuesday	Thursday
1	10/3 Introduction, Orientation, Safety, Experiment 1 Description & Preparation ** Students must be present this day to secure their space **	10/5 Experiment 1.1: Two Base Extraction of Excedrin Students work in pairs
2	10/10 - Complete Experiment 1.1 Begin Exp 1.2 – Column Chromatography Students work in pairs	10/12 – Exp 1.1 report due Complete Exp 1.2 NMR Tours & Worksheet Experiment 2 Preparation
3	10/17 – Exp 1.2 report due Exp 1.1 revisions due Experiment 2, Group A Identification of an Unknown Students work individually Group B – ChemDraw & SciFinder	10/19 – Exp 1.2 revisions due Experiment 2, Group B Identification of an Unknown Students work individually Group A – ChemDraw & SciFinder
Chemdraw & SciFinder tutorials in McHenry Library Digital Scholarship Commons. Register for passwords & find the DSC by 10/13.		
4	10/24 – Lab Clean-up/transition Experiment 2 report due Writing workshop, laptops ok Experiment 3 preparation	10/26 Experiment 3 – work in pairs Separation & Identification of Two Unknowns (Extraction)
5	10/31 - Experiment 3 – Extraction cont'd Experiment 2 revisions due	11/2 – Experiment 3 – Purification students work individually
6	11/7 – Experiment 3 - Characterization	11/9 – Lab clean-up/transition Experiment 3 report due , revisions due date TBA; Experiment 4 prep Writing workshop – peer review
7	11/14 – Experiment 4 – Two-Step Synthesis of (+)-Nopinone work in pairs	11/16 – Experiment 4
8	11/21 – Experiment 4	11/23 – Experiment 4
9	11/28 – Experiment 4 Exp 4 Progress Report Due (Results & Experimentals)	11/30 – Thanksgiving – no lab
10	12/5 – Experiment 4	12/7 – Dry Lab Experiment 4 Draft Due Writing workshop – peer review Lab Clean-up

Revised Exp 4 report due 12/11 by 5 pm in Chad Higa's mailbox in PSB.

CHEM 146A – Advanced Organic Chemistry Lab
UCSC, Department of Chemistry and Biochemistry

Instructor: Dr. Caitlin Binder
Email: cambinde@ucsc.edu

Office Location: Thimann Labs 313
Office hours: During labs or by appt.

Teaching Assistants: Chad Higa (cmhiga@ucsc.edu) & Ryan Noland (rnoland@ucsc.edu)

Course Prerequisites: CHEM 8L/M, 110L **Course Fees:** \$55 materials fee

Lab Meetings: TuTh 1:30 – 5:30 p.m. see schedule

Required Materials

- Any Experimental Organic Chemistry textbook, such as...
 - Mohrig, J. R., *et. al* "Techniques in Organic Chemistry" Freeman (any edition)
 - Palleros, D. R. "Experimental Organic Chemistry" Wiley, 2000.
- Lab Notebook – no carbon copies needed, get a fresh new notebook of any kind
- Goggles & Lab Coat (provided) or your own approved safety goggles (no glasses).
- Check email and class website frequently for updates and supplemental materials:
<https://acrochem.sites.ucsc.edu/chem-146a/>

Required Assignments

There are four distinct laboratory experiments to be completed and there will be four written assignments to be completed using proper technical writing and specific notes given within each experiment. Students are given opportunities to work on, revise, and otherwise get help with reports during lab. The minimum passing grade for each experiment is 70%. Students will also tour of the lab space independently to locate the equipment and safety features of the labs. A brief activity will be completed and shown to the instructor before leaving lab on the first day.

Laboratory Notebook

An up-to-date, current laboratory notebook should be kept while doing experiments. The notebook will be checked periodically and will be turned in with the reports. Students that do not have notebooks completed on experiment days cannot participate in lab and will receive zero points for that day's work. See full details on the lab notebook on page 14 and specific notes within each experiment.

Absences & Lateness – Communication is Key!

If you absolutely need to be late for or miss a lab or two, *pre-arrange this with the instructor*. Students that are late or absent without notice will lose points on the corresponding reports. Experiments 1 and 2 **cannot** be postponed, however there is some flexibility in Experiments 3 & 4. This does not mean that you are free to miss labs on a causal basis: email the instructor the night or morning before at latest. **More than one non-prearranged absence can be grounds for a Fail (F) in this class. No make-up laboratory sessions will be arranged!**

Illness. Casts and Crutches. Pregnancy

If you are ill, you **should not attend** lab and, as stated above, should contact the instructor as soon as possible. In the circumstance that you must wear a cast, a sling or use crutches, please contact the instructor immediately, before your next lab section, so we can arrange the best possible accommodations for you. Also contact the DRC (Disability Resource Center 831-459-2089) as soon as possible. If you are pregnant or intend to get pregnant during the course of this quarter, please contact the instructor before your next lab section to obtain important information about chemicals and pregnancy. Also, we recommend that you consult with your physician about this subject.

Assignments Overview****All drafts & reports must be printed and in-hand at the beginning of lab******Experiment 1: Column Chromatography & Acid-Base Extraction**

In the first two lab periods, students will revisit two techniques from 8M to separate the active ingredients in Excedrin: column chromatography (Exp 1.1) and acid-base extraction (Exp 1.2). Before the experiment, students type responses to pre-lab questions and a summary/introduction paragraph describing the theory behind each experiment. The lab notebook must be prepared with the descriptive, yet concise experimental details. The summary paragraph will be revised for the report, using feedback from the instructors. The main results are typed in another brief paragraph, tying the results back to the theory behind the experiment. Students work in pairs on the report, as described on pages 12-13.

Exp 1.1 report is due 10/12 with revisions due 10/17.**Exp 1.2 report is due 10/17 with revisions due 10/19.****Experiment 2: Identification of a Single Unknown**

The structure of an unknown compound with no more than nine carbon atoms will be determined by IR spectroscopy, chemical tests, and provided $^1\text{H-NMR}$. Students work individually on this experiment.

Exp 2 report is due 10/24 with spooky revisions due 10/31.**Experiment 3: Separation & Identification of Two Unknowns**

Each student will be given a unique mixture of two organic unknowns, which will be separated by acid-base extraction. Students will work in pairs on the separation, then each student will purify and analyze one compound individually. Spectroscopic analyses (IR, ^1H and ^{13}C NMR) will be performed to determine the structure of the unknown. The lab report will consist of a record of the separation, purification, and recovery, as well as the fully assigned spectra with discussion of the structural analysis.

Exp 3 report due 11/9 with revisions due TBD.**Experiment 4: Two-Step Synthesis of (+)-Nopinone**

Students will perform a two-step synthesis, including optimization of the second step and purification of both steps. Products will be analyzed via IR and NMR spectroscopy.

Progress report (results & experimentals) due 11/28. Draft due for peer review 12/7.**Revised Final Report due in Chad Higa's mailbox in PSB Monday, December 11th by 5 p.m.****Grading**Punctuality, Preparedness, & Cleanliness (includes intro activity): **20%**Technical Skill & Safety Compliance (evaluated by the instructor and TA): **15%**Experiment 1: **10%**Experiment 2: **10%**Experiment 3: **20%**Experiment 4: **25%**

Note: all experiments and written assignments must be completed on time to pass the course. A minimum grade of 70% will be needed to pass each experiment.

A typical grade distribution is as follows:

A = 90-100%; B = 80-89%; C = 70-79%; D = 60-69%; F = < 50%.

Introduction to Chemistry 146A

This lab manual contains detailed instructions to set you up for success in this course. Attention to detail and safety are emphasized above all else. General and specific details are provided throughout the lab manual, some of which are redundant. Come to the instructors immediately if there is conflicting information. Please read these introductory pages carefully before the first class meeting. Students who do not come properly dressed for the lab will not be allowed in the room. This includes the first day of class or check-in, which may result in you being dropped from the class. Students who do not follow the safety rules during the course of the lab will be asked to leave. This may result in failing the class.

We want to emphasize that a collegial and professional atmosphere is mandatory in these lab sections. The teaching assistant and instructor are here to help you. Our philosophy is that we are here to act as your research advisors and, hopefully, to convey to you some of our own passion for organic chemistry. **Your part of the deal is thinking, preparing and asking questions, no matter how stupid you might think they are.** Collegial interaction and cooperation is encouraged. That means that you should feel free to consult with each other and with the TA about the chemistry that you are doing. It does not mean that the TA or another student does your lab work for you.

Please remember that the amount of time available for laboratory work is limited. The laboratory is the place to make observations; use time outside the lab for planning and consulting the literature. It is essential that you have a plan of action when you arrive at the laboratory. This means that you must plan ahead for the experiments. You cannot afford to look information up as needed, unless the procedures specifically instruct you to do so.

The accurate and concise communication of research results and the ideas generated by these results is paramount in every branch of science. Maintenance of a neat, professional, and **permanent laboratory notebook** is an important objective of this course. Whether you write large or small, neat or not so, if the information in your notebook cannot be read, then that information is worthless. In addition, please remember that "bad results" are at least as important as "good results." All entries in your notebook should be made in ballpoint pen (so it will not "run" if wet). Your lab book must have bound, consecutively numbered pages.

Take good care of your bench space. Keep it clean and tidy at all times. Keep the reagent counters, fume hoods, and the balances clean. If you spill a small amount of a solid when transferring or weighing it, clean it with wet paper towels and dispose of the towels in the solid-waste container; wear gloves during this process. Keep reagent bottles and Erlenmeyer flasks well capped. Do not move reagents around the lab.

There are two main adjoining rooms for the bulk of student work with a third adjoining room with the reagents, waste, and IR. Be considerate of the fact that one TA is primarily supervising 16 students. The instructor (Caitlin) will either be across the hall in her office or in the lab. **Students should stay in the room with their assigned drawer, going into the third room only to get necessary materials then returning to the designated workspace.** *In other words, know what you need before you move to a different room!*

All products made or purified in the lab should be stored in a screw-cap vial or a plastic bag that is properly labeled with the compound's name, melting point (if applicable), mass, your name and the date. The vials or bags are to be turned in immediately after completion of the experiment to the stockroom or your TA unless requested to do otherwise. Any compounds kept for the next lab period must be in clearly labeled vials in the desiccator in your assigned drawer.

Have fun, and learn as much as you can! Again, your TA and instructor are committed and approachable!

LABORATORY SAFETY

A laboratory should be a safe and comfortable place to work, but no environment is safe without the cooperation of its inhabitants. Although the experiments in this class do not involve extremely dangerous substances, the use of hazardous chemicals cannot be entirely eliminated. Before engaging in experimental work, read the following guidelines and observe them at all times in the laboratory. For more information about laboratory safety visit the site for the UCSC Environmental Health and Safety (EH&S; <http://ehs.ucsc.edu>).

“Safety First!”

Violation of any of the rules below may result in you being removed from the lab and/or you will receive ZERO for results portions of the lab (credit granted for preparation only – introduction & notebook). A second violation will result in you being dropped from the course.

No make-up labs for students who violate these rules.

GENERAL SAFETY GUIDELINES

Attire

Wear safety goggles at all times no matter what you are doing or where you are in the lab. For maximum protection against splashes, safety goggles should not have open holes on the sides; the venting apertures, necessary to minimize fogging, should have splash guards.

Goggles with antifog lenses are commercially available. If fogging occurs, clean the lens with a piece of tissue paper and antifog lotion available in the laboratories. Repeat the cleaning as necessary. This operation should be performed outside the lab. If you need prescription glasses wear them beneath the safety goggles.

Lab coats are provided in the lab and must be worn over appropriate lab attire (see below). *You will lose points every time you are told to put on or button your lab coat.*

Clothing is only a first line of defense against chemical exposure. Any clothing worn tightly to the skin acts as a sponge to directly deliver chemicals to your skin. Consider this in choosing your wardrobe for the day, along with the following specifics. Students that are not dressed properly cannot participate in lab, cannot go home to change, and will receive zero points for the day.

- **OK LAB ATTIRE:** Pants or long skirt, short or long-sleeve shirt, closed-toe shoes that cover the entire top of the foot. Long hair and loose clothing are confined or tied back.
- **NOT OK:** Shorts or short skirts (no exposed ankles), *leggings/tights*, cropped pants that expose ankles, ripped pants that expose skin, tank tops, sandals, ballet flats, or any other shoes that expose the tops of the feet (Crocs and Tom's are NOT OK!). High heels, baggy clothing, and dangling jewelry are strongly discouraged.

Headphones cannot be used in the lab.

Cell phones cannot be used in the lab and must be turned off.

Bikes cannot be kept, locked or unlocked, inside the building. This includes hallways, labs, instrument rooms and stockroom.

Good Laboratory Habits

Use common sense.

Do not eat, drink, smoke, or apply makeup.

Take a short break if necessary and please let someone know you're leaving. Wash your hands before you go outside or check out the greenhouse and breathe fresh air. A ten-minute break during a 4 hour lab period is refreshing!

Do not bring drinks or snacks into the lab, even if hidden in your backpack. Leave drinks and snacks on the designated table outside. Take off your lab coat and wash your hands before leaving the room and snacking.

Never use laboratory glassware for food or drink. Do not use the ice from the ice machine and the industrial water from the laboratory faucet for a drink.

Never leave an on-going experiment unattended. If you have to leave the lab for a few minutes, notify your TA. Overnight reactions must be in secondary containment

Do not keep your books, backpacks, and coats on the bench-top. Instead, keep them in the designated area.

Do not obstruct the aisles with belongings, stools, or open drawers.

Do not sit on the benches!

Keep exits and aisles free of obstructions at all times.

Do not keep personal electronic devices (laptops, cell phones, etc) on the lab bench, with the exception of dry lab days. If there is a spill they may get damaged and you may lose important data.

Keep your bench space clean and tidy at all times. Make sure to clean it before you leave.

Do not perform unauthorized experiments. Such experiments are strictly prohibited.

Do not invite or receive visitors in the laboratory.

Do not rush. Do not run. Do not push.

Do not engage in horseplay and practical jokes in the lab.

Precautions

Before each experiment, familiarize yourself with the hazards (flammability, reactivity, stability, and toxicity) of the compounds involved. Such information can be found in the Material Safety Data Sheets (MSDS) provided by the manufacturer. They are kept in the stockroom (Thimann 281) and are also available on line. Consult also the Merck Index for additional information. Record this information in your lab book.

Be aware of your surroundings. Know what your neighbors are doing. If somebody in the lab appears to be performing an unsafe operation, point out the hazard immediately. Prevention is always the best medicine.

Never use open flames in the laboratory without your instructor's permission.

In case of an emergency evacuation of the building, all the students and instructors should meet outside the building at a spot designated in advance by the instructor. The meeting place for Thimann Labs occupants is the grove between Thimann Labs and Kerr Hall.

If you are pregnant or planning a pregnancy while taking the organic chemistry laboratory, contact your instructor and your doctor. They will provide you with information regarding potential risks to you and the embryo.

If you have to wear crutches or a sling, contact the instructor immediately, before going to your next lab section. Also contact the Disability Resource Center (DRC) (<http://drc.ucsc.edu>; phone: (831) 459-2089). If contacted with enough time they can arrange for a scribe and/or a lab assistant to help you.

Before Leaving the Lab...

...Clean the bench tops and fume hoods. Other students will appreciate a spotless work area as much as you. First wipe the bench with a wet sponge using elbow grease, then dry with a paper towel. Repeat if necessary. If streaks are left on the bench, you will lose points (the streaks are likely contaminants).

...Perform your community task and initial the table on the door.

...Turn off gas, water, air, steam and vacuum valves at or near your bench space.

...Unplug all electrical appliances (hot plates, heating mantles, water pumps, etc.). Never unplug or turn off GCs, IR instruments, GC carrier gas.)

...Wash your hands thoroughly with soap and water.

* Work together to clean the entire lab as you go along. Just because one person is assigned a community task, that does not leave you leave all the work to them! Ex. ask around if it looks like everyone's done with the rota-vap and shut it down.

Handling Chemicals

Consider all chemicals poisonous.

Use the fume hood when handling organic solvents and volatile compounds.

Never use your mouth to carry out a chemical operation (fill a pipet, start a siphon, etc.).

Dispose of chemical waste in the containers provided for that purpose. They should be clearly labeled and are usually placed in the fume hood. Follow proper procedures as indicated by your instructor and this lab manual.

Do not contaminate reagents. Most organic chemicals are very expensive. Use clean and dry pipets to dispense them. Take just the amount you need, do not waste them. Never pour unused reagents back into stock bottles.

Keep stock bottles in their designated spots, so everybody can find them easily.

Label all containers. Do not use chemicals from unlabeled containers.

Read labels carefully.

Do not inhale, smell, or taste chemicals. Never touch your face without washing your hands.

Wearing Gloves

Wear gloves prudently. There are several types of gloves offering different levels of chemical protection. Always check their chemical resistance and recommended usage. If they are not worn properly, they will only give you a false sense of security.

In the labs we will provide you with nitrile gloves. Wear them when handling organic solvents and specific chemicals as indicated in the experiments.

Do not wear them while washing glassware.

Remove them when you go outside the lab (even if it is only for a short trip to the stockroom).

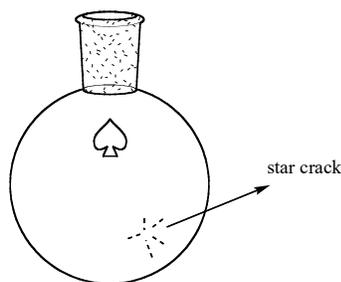
Change them frequently: every time you work with a toxic compounds, especially strong solutions of acid or bases, and definitely when they get soiled or punctured.

Do not handle solid chemicals directly with your gloves, always use a spatula.

Do not reuse contaminated gloves.

Handling Glassware

Check your glassware before use. It is important to check round-bottom flasks and condensers carefully. "Star cracks" may cause glassware to break. Do not use any piece of glassware with a crack; bring it to the stockroom for an exchange.



When inserting (or removing) a piece of glass tubing or thermometer into a stopper or hose, always wrap the tubing with paper towels or a cloth to avoid cutting yourself. Use water, glycerol or grease as lubricants as necessary. Hold the tubing as close to the insertion point as possible and apply a slow rotatory motion. Keep your hands far from your body and face.

Place broken clean glassware in the appropriate disposal container, usually located on the floor. Do not place it in the trash.

Place broken or disposable contaminated glassware (including Pasteur pipets) in the appropriate solid hazardous waste container usually located in the fume hood. Do not place it in the trash. It may puncture the trash bag and cut the person who empties the trash.

If two ground-glass joints get "frozen" do not try to unlock them by applying a torque as they can break and hurt you. Notify your TA instead.

In Case of Accident

If you injure yourself, notify your instructor immediately. Check your local emergency number.

Small cuts can be treated by washing the wound, removing any pieces of glass and applying pressure with a sterile pad. The First Aid Kit is located in the stockroom (Thimann 281).

Do not move injured persons unless they are in further danger.

If chemicals get in your eyes, immediately flush them with water for at least 15 minutes using an eye-wash fountain or eye-wash cup. Seek prompt medical attention.

In case of ingestion of a hazardous chemical contact the local Poison Control Center immediately. The phone number should be posted by the emergency phone (Thimann 281). Meanwhile follow the first aid instructions shown in the MSDS. Never give anything by mouth to someone who is unconscious.

In case of small fire, get your instructor's attention immediately and follow instructions. In case of a large fire evacuate the building immediately. See instructions under In Case of Natural Disaster or Fire Alarm.

If your clothing is on fire, do not run. Use water, a blanket, or a coat to put out the fire. If necessary, the person should roll on the floor. Get prompt medical attention.

Spills

If you spill a chemical on your skin, remove all contaminated clothing and immediately flush with cold water for at least fifteen minutes. Notify your instructor. Check the MSDS for delayed effects. Check for a reaction during the next 24 hours. See a physician.

If you have a chemical spill on a large area of your body, use the safety-shower immediately as you remove any contaminated clothing. Avoid spreading the chemical on the skin. See a physician.

If you spill a nonhazardous solid or liquid, immediately wipe it up using spill mats. If the spill is large (> 100 mL) or if it poses a danger to you or someone else, notify your instructor. Do not attempt to clean up large spills.

If you spill a hazardous material notify your instructor immediately.

Dispose of material used to clean up a spill in the proper waste containers.

In Case of Natural Disaster or Fire Alarm

If the fire alarm goes off stabilize any ongoing experiment by turning off gas, water, vacuum, and any source of heat that you may be using (do this only if it does not pose further danger to you) and exit the building as soon as possible. Do not run.

Do not use the elevators to evacuate the building. Gather outside the building in the pre-arranged spot. For Thimann occupants the meeting place is in the grove between Thimann Labs and Kerr Hall (off the road).

In case of natural disaster such as an earthquake, if possible, find shelter under a desk or a door frame. Duck, cover (at least your head with your arms) and hold (to a sturdy piece of furniture or frame). When the tremor has subsided turn off gas, water, steam, vacuum and any source of heat that you may be using (do this only if it does not pose further danger to you) and exit the building as soon as possible. Always take your personal possessions with you if doing so does not pose further danger. Do not run. Never gather next to a building as falling debris may hurt you.

Community and General Cleaning Descriptions

* **A table with community cleaning assignments will be posted on the first day of lab. On each day, initial that you've done your task at the end of every lab or you get zero clean-up points for the day ☹**

* **This is in addition to cleaning your own workspace, including a pristine drawer with no extra, missing, or dirty items. Drawers will be checked without warning and points taken off for each infraction. These penalties will increase as the course progresses, if necessary.**

Reagents and Solutions – Check it is at least $\frac{1}{4}$ of the way full and in the correct place. Notify TA if empty or near empty. Do not re-make solutions.

Gloves, Pipets, Paper Towels – Check all glove boxes in the main labs (314/318). Bring in new boxes from the stockroom (322) if boxes are empty or close to it.

Soap & Sinks – Check all sinks have full dish soap dispensers. Re-fill using stock containers under the sink. Concentrated soap under sink in 322. Notify the TA if the pink hand soap is near empty – do not refill hand soap with dish soap! Remove any debris from sinks.

Waste containers – clean any spills in secondary containment (ask for help if needed, do not lift carboys), cap all containers, notify TA if full

Benchtops clean – Use a wet sponge followed by dry paper towel to clean & dry every benchtop, including fume hood space. Alternate who cleans the benchtops in 322. Bring any stray equipment to the TA or, even better, ask around to find out who it belongs to!

Floors swept – spot sweep every lab, full sweep at once/week. Alternate who sweeps 322.

Drying Rack – beginning or end of lab – put dishes away from the drying rack - applies to shared glassware not in lockers. Bring any stray glassware to the TA or, even better, ask around to find out who it belongs to!

Equipment organization in cabinets – any shared equipment (hotplates, sand baths, clamps, etc.) is neatly organized in each of these cabinets every day

Equipment turned off – rota-vaps unplugged, water pumps off, buckets empty & upside-down in the sink. All other equipment (hot plates, etc.) is unplugged and neatly put away.

Stockroom (322) – check that all benchtops, including the IR station, are clean. Notify the TA if any stock items are missing. Double check that hoods are clean and waste bottles are capped.

LOCKER EQUIPMENT
THIMANN 314, 318

Some items are provided in the room for everyone to share. Extras of locker items are also available. Please come to the stockroom in Thimann 281 for additional glassware.

Beakers

- 50mL
- 100mL
- 150mL
- 250mL

Bottle, wash

Bulb, small

Clamp, screw

Cylinders, graduated

- 10mL
- 25mL
- 100mL

Dish, Crystallizing

Filter vac

Flasks, Erlenmeyer

- 50mL
- 125mL
- 250mL

Flasks, filter

- 50mL
- 125mL

Forceps

Funnels, glass

- 25mm
- 65mm

Funnel, Buchner

Plurige

- 1mL
- 3mL

Rings, cork

- 2"
- 4"

Rods, glass stirring

- regular (3)
- micro

Ruler

Scoopula

Spatula

- regular
- micro

Split stopper

Stir bar

- 0.5"
- 1"

Watch Glass

- 100mm
- 125mm

Organic Chem Kit

Round Bottom Flasks

- 500mL
- 250mL
- 100mL
- 50mL
- 25mL

Adapters

- Claisen
- 3-Way
- Vacuum
- Straight tube

Condenser, West

Separatory funnel, 125mL with 19/22 stopper

Neoprene thermometer tip

LAB MAP – Safety & Orientation Activity

After familiarizing yourself with your locker equipment, find the following items in your assigned lab room and make a map in your notebook. Feel free to open any and all drawers and cabinets in your lab room to get to know your space. Check this with your TA.

1. Hotplates, lab jacks, and sand baths
2. Thermowells and rheostats - for heating RBF's
3. Crystallization dishes - for water baths
4. Vials – for product storage
5. Water lines – for water-cooled condensers
6. Rota-vaps – note the one closest to your station
7. Chemical spill mats
8. Glass pipets
9. Filter paper
10. Gloves
11. Parafilm
12. Boiling chips/stones, MgSO_4 , pH paper, copper wire, scissors & tape
13. Foil and cotton
14. Soap refill
15. Glass waste
16. Fume hoods
17. Beakers
18. Erlenmeyer flasks
19. Test tubes
20. Larger filter flasks
21. Vacuum tubing
22. Clamps, support rings, clamp holders, ring stands
23. TLC plates, chambers, tygon tubing for columns
24. Eye wash station
25. Safety shower
26. Fire alarm, fire extinguisher
27. Evacuation route

In the adjoining stockroom, please find the following but do not touch or move anything in this room. This is a semi-restricted area. For most labs, students will only be allowed in this room with permission and in designated areas only.

28. Fume hoods – these will be designated as waste or reagent hoods
29. Flammable solvents cabinet
30. Acid cabinet
31. Refills of gloves, kim wipes, pipets, etc.
32. IR Spectrometer

KEEPING A LAB NOTEBOOK

1. Use a bound notebook (not loose leaf!). Number all pages ahead of time if they are not pre-numbered. Never remove pages from the notebook.
2. Leave room at the front for a table of contents and fill in with the experiment number & title and descriptive but brief subtitle every day (Ex. "Exp 2, Single Unknown – TLC" or "Exp 2, Single Unknown – Lucas Test").
3. Use a title for each new experiment and begin each new experiment on a new page. Your title may use chemical structures rather than long chemical names when referring to a specific organic reaction.
4. Start a new notebook page each day. Add the date to the page where you are working as you start lab work each day. Fill out the lab book as you go, rather than after the fact. This will help you keep track of what you have done, and provides a record for others to follow.
5. **When performing a chemical test or reaction,**
 - **...start a new notebook page and draw the reaction scheme at the top of the page (reactants, arrow, expected products) followed by...**
 - **...a table with chemical info and properties (mmol, mg, mL, MW, bp or mp, density, and hazards). Use the reaction scheme to define abbreviations for chemicals to use in the reagent table for simplicity.**
 - **After the reagent table, give a concise description of what you plan to do and leave space to make changes based on your experience in the lab. With a few exceptions, you may not refer to the lab manual while performing the experiment.**
6. Don't compress multiple parts of experiments onto a single page. There are many pages available in the lab notebook and it should be easy to find everything based on page titles and the table of contents.
7. Write neatly enough for other people to be able to read what you have written. Don't agonize about being too neat: it just needs to be well organized and legible, not perfect!
8. There is no need to use complete, grammatically correct sentences in your lab notebook: this should be reserved for your laboratory reports. An example might be: "Isolated amine as 2.3 g of off-white solid. Recrystallized from methanol (1 g of amine in approximately 15 mL methanol; recovery: 0.85 g). mp (crude) = 123-129 °C; mp (recryst.) = 130-132 °C."