

## Laboratory Policies

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### I. Academic Dishonesty

Academic dishonesty will not be tolerated! Even when you are working with a partner, you are expected to work independently in making experimental observations, doing final calculations, and writing final interpretations. Conversations with other students about chemical topics, including preliminary interpretations, are *strongly encouraged* for you to sharpen your understanding of chemical concepts and gain experience in using the language of chemistry.

However, be careful not to cross the line that separates such legitimate help from outright cheating. It is fine to ask for explanations of concepts, procedures, techniques, calculations, etc., and then to tackle the work on your own. It is not acceptable to copy another student's work (even prelabs, outlines, etc.), or to let your study partner do most of the work. Any assignment turned in should represent your intellectual achievement, not a copy or paraphrase of someone else's. Even if you have collaborated with other students, you should write your report separately. If you appear to be too dependent on others while working in the lab, your TA will deduct points from your lab grade.

When working in collaboration with another student, follow these guidelines to make sure you are submitting your own work (adopted from <http://www.haverford.edu/math/collaboration.html>):

- You should think about the problems independently **before** collaborating or seeking help.
- You should never work with someone while writing up a final solution to be turned in. Working together is fine, but when you feel you have a good grasp of the solution, write it up separately, using none of the writing that was produced during the collaboration. Throw away any paper your tutor or friend wrote on before you write up your final report.
- If, when writing up the problem, you discover that you cannot remember the solution, you in fact have not understood the concept. Give it more independent thought, and then if you feel you need help, put your solution away and go back to your collaborators.

It goes without saying that all forms of cheating are forbidden, e.g., faking of data, using crib sheets on exams, etc. If you have any question about what constitutes academic dishonesty, consult your copy of "Doing Honest Work in College" by Charles Lipson or ask your instructor. Anyone caught cheating will be reported to the Dean of Students in the College. In addition, the total grade for the experiment in question will be reduced to zero, and the course grade (not merely lab grade) may be reduced as well.

## II. Safety

With normal good judgment, the chance of an accident in this course is small. Nevertheless, some of the materials used in the laboratories can be dangerous if mishandled, so the following simple safety rules and precautions are essential.

### Safety Rules:

- i. **Eye Protection**, i.e. chemical splash goggles, must be worn **at all times**. You will be issued a pair of goggles during your first University of Chicago chemistry course. This pair will be required for all your remaining chemistry courses at the University. Use of goggles other than those provided must be approved by the Lab Director.
- ii. **Rubber Gloves** must be worn during chemical manipulations, including washing glassware.
- iii. **Laboratory Aprons** must be worn in all chemistry laboratories.
- iv. **Clothing** must cover the legs and shall not be loose or flowing in order to prevent it from coming in contact with hazardous chemicals or mechanical equipment and also to prevent cross contamination of the work environment. Therefore, no skirts or shorts are allowed in lab.
- v. **Shoes** that cover the entire foot are to be worn while working in the laboratory. Shoes with open toes or other exposed skin, such as sandals, are prohibited.
- vi. **Hair** shall be secured back and off the shoulders in such a manner as to prevent it from coming in contact with hazardous chemicals or mechanical equipment, and also to prevent cross contamination of the work environment.
- vii. **Hand Washing** shall be conducted before taking a break and at the end of each laboratory session.
- viii. **Contact Lenses** are prohibited in all chemistry laboratories because they may absorb certain solvent vapors. In addition, contact lenses represent a special hazard in the event of chemical splash to the eyes, because they tend to concentrate hazardous chemical materials against the cornea and prevent tears from washing it away.
- ix. **Fume Hood Sash** must be closed to the level indicated by the certification sticker. Keep your head and torso outside of the fume hood.
- x. **Experiments** must never be left unattended. Once you begin an experiment, you may not leave the building unless you have gotten permission from your TA.
- xi. **Application of Cosmetics** is prohibited in the laboratory.
- xii. **Smoking** is prohibited in the entire Kent chemistry building.
- xiii. **Eating and Drinking**, including gum chewing will not be permitted in the laboratory.
- xiv. **Cell Phones and Personal Audio Devices** are prohibited in the laboratory.
- xv. **Mouth Pipetting** is prohibited.

- xvi. **Glassware** that is broken, cracked, or chipped shall not be used. Dispose of all broken glass in labeled containers.
- xvii. **Open Flame Devices** shall never be left unattended.
- xviii. **Electrical Cords** shall be kept away from sinks and walkways. All damaged electrical cords shall be reported to the laboratory technician.
- xix. **Aisles** must not be obstructed in any way. No equipment, chairs, supplies, or trash are permitted in exit passageways or aisles. *Coats and bookbags must be stored in the hallway lockers.* Doors to the laboratories shall be kept closed, but exit doors must not be blocked, bolted, or obstructed in any way to block access.
- xx. **Housekeeping** shall be performed continuously. The laboratory work area must be kept neat and orderly. A disorganized and sloppy laboratory work environment represents a safety risk. Repeated offenses will result in several point deductions for the day's lab.

When working in the lab, always remember that there are others working around you and others who will be working in the same space after you leave. Be considerate. Dispose of all glass in the broken glassware box and syringes/needles in the sharps container. If you do not know where these are, please ask.

Many of the chemicals you will use this year are quite toxic and corrosive. It is important that you are aware of all chemical hazards and come to lab prepared! Guidelines can be found in each lab experiment, and information can be found on the MSDS sheets for each chemical. These are available online.

The following are some common sense tips on how to minimize the risk of coming in contact with chemicals in lab. While most experiments are designed to reduce the number and amount of hazardous chemicals, this is still an organic chemistry lab and the avoidance of all chemicals is neither practical nor advantageous for your education.

- i. **Cross Contamination:** This is the most common problem with chemicals in the lab. You must be mindful of what you are touching with your gloves as to not leave chemical residue on surfaces that you will touch with your bare hands. Washing off the outside of your gloves at the end of lab will go a long way to keeping the lab and your personal items clean.
  - Doorknobs – Everyone opens the lab doors at one point in the day without gloves on, so please remove yours before touching the doorknobs.
  - Pens – It's a good idea to have a specific lab pen that you only use with your gloves on. If you have a bad habit of chewing on pens, lab is the worst time to do this. Chewing on the end of a pen that you just used with your gloved hand is a good way of getting chemicals in your mouth.

- Lab notebooks – While it is helpful to have your notebook close by to record any observations, be careful not to put it in any spilled chemicals in your hood. This transfers any chemicals to your bag or other books when you bring it home.
  - Instruments – While in the instrument room, remove your gloves before using the melting point apparatuses and IR machines. This will keep your fellow students safe and keep organic chemicals from eating away at the knobs. If you suspect a surface you are about to touch has chemicals on it, clean it up.
  - Cell phones – It's not a good idea to text or talk on your cell phone (out in the hall) while wearing gloves. Remember cell phones are not allowed in lab.
  - Exposed skin – Remove your gloves before scratching your head or rubbing your face. Folding a cuff at the end of your gloves will keep liquids on your gloves from running down your arm when you raise your hands.
- ii. **Clothing:** As stated elsewhere in the lab manual, any clothing that shows your feet, legs, and shoulders is not permitted. It is also prudent to wear long sleeves to lab to cover your arms in the event any spilled or sprayed chemicals gets on them. The aprons from General Chemistry lab are not strong enough to withstand most organic chemicals, so leave them at home. Your Sunday best is also not a good choice of clothes for chemistry lab. It only takes one drop of acetone to alter the look of your leather shoes.
- iii. **Minimizing the smell:** When you are working with chemicals that have a strong odor, make sure you rinse out any pipettes or test tubes before you throw them in the broken glass container to keep the lab from filling up with the vapors. Rinsing off your gloves will help keep cross contamination to a minimum. You probably don't want to go home smelling like chemistry lab.
- iv. **Labeling your glassware:** Keeping track of what chemical is in what beaker will help you with the experiment, but will also help in the event of a spill. If you don't know what colorless liquid spilled on your bench, how will you know how to clean it up? This is especially poignant since most organic liquids look like water.
- v. **Personal responsibility:** Being aware of your surroundings is one of the most important ways to keep yourself safe in lab. This is not to say that you can't talk with your neighbors, just don't become so involved in the conversation that you don't notice your reaction boiling over. Your safety in lab starts with you.

### III. Attendance

Attendance is mandatory for each experiment listed in the schedule. You will not be allowed to pass the course without completing all lab experiments and lab reports. The lab period begins promptly at 1:30 PM and ends at 5:30 PM. You must be in lab at 1:30 PM – these lab experiments may require the full four hours. It is important that you be on time to get the prelab notes from your TA about safety and procedure.

If you are more than 20 minutes late to lab or miss lab without a valid written excuse, you will not be allowed to perform the experiment and will have to make up the lab on a later date with a late penalty of 50 points deducted.

If you miss a lab due to illness, you must notify Dr. Keller within 24 hours of your lab period. You must bring a doctor's note to corroborate your illness and be able to make up the lab without a late penalty.

If you need to miss a lab for a valid reason other than an illness, you must notify Dr. Keller the week before the lab you will miss. Valid reasons do NOT include needing more time to do schoolwork or social obligations. You must bring a document to corroborate your absence.

A permission slip must be obtained from Dr. Keller before you can start your make up lab. Your make up TA will then sign it and record your prelab score. Your lab report for the make up lab will be due at 1:30 one week after it is completed. All assignments (notebook pages, prelab quiz, lab reports) must be given to Dr. Keller, not your make up TA.

### IV. Check In/Check Out

On the first day of lab you will be given two lab drawers with their own keys. As you check in, make sure all your glassware is present, clean, and unbroken, and that both keys work properly. If something is broken or missing, obtain a replacement from the laboratory technician in Kent 310. When your drawers are complete, sign the laboratory check in form. Once you sign the form, you are personally responsible for the equipment in the drawers. Make sure you lock both your lab drawers before leaving lab at the end of the day.

After you sign the laboratory check in form, if you lose or break glassware, you must obtain a replacement from the laboratory technician in Kent 310. The cost of the piece of glassware listed on the check in sheet will be placed on your personal tab. At the end of the quarter, your tab will be totaled and you will be responsible for paying the fee (cash only) on the last day of lab. Failure to do so will result in a withheld grade for the course.

Any glassware left out at the end of lab will be placed in the Lost and Found glassware drawer in your lab. If you are missing something, check this drawer first. Be careful not to lose your stirbar in either the waste containers or down the sink.

Drawer keys are \$5 each if you lose them. Notify the laboratory technician immediately if you have lost your keys.

On the last day of lab for the quarter, you will check out of your drawers. Check out should take less than 5 minutes if your glassware is clean and organized. If you group your (clean!) glassware according to type, it will expedite the process. Once your glassware is present and accounted for, you must turn in your keys and pay any fees for broken or missing glassware.

## V. The Lab

The reagents for the experiments will be set out in the central hoods and will remain in the central hoods. Under no circumstances should they be taken to your hood or your bench. This is to minimize the chance of a spill and to keep the chemicals where all can find them.

Acetone will be available at the center hoods for rinsing glassware. It may only be used at the center hoods. Waste acetone must be disposed of in the organic waste bottle. See the Zubrick text for a discussion of how to wash glassware in Organic Chemistry lab.

At the end of every lab period, you must return all common equipment (hot plates, ring stands, test tube racks, clamps, etc.) to their original position. Any spilled chemicals must be cleaned up. If you are unsure on how to clean up, ask your TA. Your hood and benchtop space should be clear of equipment and trash. Be sure to place all broken glass in the broken glass disposal boxes and used needles in the sharps container. Once you have cleaned up your area with a damp sponge, remove your gloves and goggles and lock your drawers.

You are sharing this lab space with other students and it is your responsibility that you work neatly and safely. The lab must be left as clean or cleaner than you found it. Violations of safety and/or cleanliness will result in point deductions for not only you, but your whole section as well.

## Preparing for Lab

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### I. Preparing your Lab Notebook

You are required to use an authorized chemistry notebook containing all the required safety information and carbonless copy notebook pages. You may reuse your General Chemistry notebook or purchase a new notebook from the bookstore.

In any laboratory setting, you must learn to depend on and trust yourself, as others will have to trust you. Therefore, this manual will not be allowed in the lab for your reference. You will be evaluated on your preparation for the lab and then turn in your carbonless copy pages at the end of the lab period. Without a prepared notebook, not only will you have no clue about what will be going on in lab, but you will also be a major safety hazard. **YOU WILL NOT BE ALLOWED TO PERFORM THE LAB WITHOUT A PREPARED NOTEBOOK.** If you are asked to leave the lab because you are not prepared, you may make up the experiment on another day with a late penalty.

The notebook is your permanent record of everything you did, saw, smelled, heard, and felt in lab. In any scientific profession, one lab notebook can be used by multiple people either to reproduce results or to collectively report data. Similarly, even though you are the owner of your current notebook, at any time someone else may be required to use your procedure and/or results. Your prepared procedure should be written in a manner that any of your peers can use it to perform the experiment. During the experiment, your observations, data, changes in procedure, and any notes should be written clearly and organized in such a way that your fellow labmates will be able to use your information to write a full and detailed lab report.

- i. **Write in pen.** If your notebook is prepared carefully, changes in amounts of reagents used or variations in the procedure can be written quickly and clearly by crossing out the original notation and replacing it or by using an arrow. Since your notebook has carbonless copy pages, erasing will not remove the data.
- ii. **Understand the reactions.** Your notebook must start out with the following parts:
  - Title of the experiment along with your name and the date the experiment is performed
  - All pertinent balanced equations
  - Calculations of theoretical yield for synthetic experiments
  - Waste disposal instructions
  - A reagent table with these headings:

| Name of reagent | Structure | Molecular weight | Amount needed | Moles | Amount used | Physical properties (i.e. density, sol., mp and/or bp) | Safety considerations |
|-----------------|-----------|------------------|---------------|-------|-------------|--|-----------------------|
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- iii. **Procedure.** The procedure in your notebook should be a “translation” of the experimental procedure from its paragraph form into “cookbook” steps. The procedures in this lab manual are written in a style similar to professional papers without many assumed steps and details (such as taring a beaker, etc.). The first time you are using a technique or piece of glassware, you will need to write in detail exactly what will happen and what the setup looks like. Again, these details are in the Zubrick lab text, not in the manual. In preparing your notebook, you must dissect the procedure into a step-by-step methodology that can be easily followed by anyone in your class.
- iv. **Leave room for observations and changes.** Between each step of your procedure, leave space for any changes your TA makes to the procedure or mistakes that were made in executing the experiment. You will also need to write down your observations for every step, so leave room for those. One common way to do this is to prepare your notebook in a two-column format. Your prepared procedure should be written in the left-hand column, and the right-hand column is kept clear for observations, data, or procedure changes.
- v. **Write in your own words.** Blatant copying of the lab manual not only shows that you are not prepared, but also is considered plagiarism. Offenses of this kind are dealt with as an academic dishonesty.

## II. What to Bring to Lab

- Your lab report on the previous week’s lab
- Your prepared notebook
- One or more pens
- Calculator
- Personal safety equipment – goggles, gloves, long pants, closed toe shoes, etc.
- Lock for the hall lockers

Do NOT bring the following items:

- Lab manual or Zubrick text
- Shorts, skirts, sandals
- Computers or other valuables

## III. Prelab Quiz

You will take a short prelab quiz the first ten minutes of lab with only your prepared lab notebook as a resource. This short quiz is given for your benefit to make sure you fully understand what you will be doing in lab. The more prepared you are for lab, the easier the prelab quiz will be.

## IV. Important Reference Material

**The Aldrich Catalog, the Chemist’s Companion, and the Merck Index.** These are available on the third floor of Kent. These reference books are not to be removed from the third floor of Kent, and can also be found in the Crerar Library.

**Crerar Library.** Sometimes the information you need can be easily found in published papers and journals. All the computers are equipped with search programs that will allow you to locate journal articles on a specific topic or compound.

**The Web.** The course website, <http://chalk.uchicago.edu>, has a folder for useful external links. The lab folder includes video demonstrations of some of the techniques you will be using in lab.

## V. Tips for Expediting Lab

The following are some common sense tips on how to reduce the time you spend in lab. Every experiment in this manual is designed to take no longer than 4 hours, so if you are struggling to finish on time you will need to make changes in your lab habits.

- i. **Be Prepared.** Being familiar with the experiment will help you save time rereading your notebook to figure out what to do next. This does not mean memorizing the lab manual, but rather having a general idea what the main operations in the experiment are. Some students spend much of their lab time reading their notebook and potentially miss important observations. Organization goes a long way to accomplishing this. This also includes reviewing lab techniques that you learned earlier in the year. Since this class is cumulative, you are expected to not only know how to perform lab techniques used in previous experiments, but also spend less time performing them.
- ii. **Multi-tasking.** While you are waiting for your reaction to finish, use the down time to do other parts of the lab. This could be preparing a sample for analysis, setting up a filtration apparatus, or washing glassware. Obtaining the chemicals for the next step can also be done ahead of time. Some experiments involve test tube reactions and these can be done in parallel. You should read an experiment with multi-tasking in mind and indicate in your lab notebook where you can perform multiple tasks at once. There's a reason why the melting point machines have slots for more than one sample too.
- iii. **Be Flexible.** Waiting in line can be a big time-waster in lab. If you see a long line to wait for a balance, do something else to set up for your experiment instead such as setting up an apparatus. Even though the lab manual lists obtaining chemicals and then assembling glassware, they don't always need to be performed in that order.
- iv. **Stay on Task.** Don't get so wrapped up in conversation that you forget what you are doing. This is not to say that you can't talk with your neighbors, just save that juicy conversation for after lab.

## Grading

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### I. Notebook Pages

At the end of each lab experiment in this manual is a series of questions that you must answer in your notebook before you step into lab. These questions are designed to help you think about the theories or techniques addressed in each experiment. They may help you predict common trouble spots in lab or how to deal with unexpected results.

Once you are in lab, you will need to record any data or observations in your prepared lab notebook. You will be graded on both these items. A small part of the notebook grade is based on how well you performed the experiment, but most is how accurately you observed the experiment. Remember that the purpose of the lab notebook is to be an accurate representation of what happened, not what you think should have happened.

When deciding what is important to record and what is not, think about what a student outside the class would need to repeat the experiment. If you are performing a new technique or using a new glassware setup, it is important to draw it for reference. Once you have done this, future experiments using the same technique can refer to the original drawing instead of redrawing it. Each step in the procedure should include some observation as well as anything unexpected that happened.

Be honest in your observations. Your TA will be in lab with you and will remember if you had a successful reaction or not. Do not try to gloss over any errors in your execution, not only will your TA catch you, but this is academic dishonesty and will be treated appropriately.

At the end of the lab period, give your carbonless copy pages to your TA to grade.

### II. Lab Reports

Your lab report should demonstrate your ability to connect your experimental results with theoretical concepts and is considered your published contribution to the scientific community. Professionals of all fields are required to publish their findings in a manner that is clear and interesting. For your lab report in Organic Chemistry, you are merely required to answer the questions that are at the end of each experiment. Don't include lengthy discussions of the theory behind the lab or any unrelated topics.

All lab reports are due by 1:30 PM one week from the day you completed the lab experiment. You will hand your lab report to your TA as you walk into lab, emailed lab reports will not be accepted. Reports that are not received by 1:30 PM on the due date are considered late. Late lab reports will be penalized 10 points per day, and must be turned in to Dr. Keller. No lab reports will be accepted for a grade during

reading period. However, all lab reports must be completed in order to pass the course. It is in your best interest to complete all lab reports on time.

Your lab report must contain the following sections: name, date, section, title, purpose, results, and discussion. The purpose is a one-sentence description of the experiment along with any reactions that were performed. The results are a reporting of the qualitative and quantitative data collected. It is important to show all calculations performed, such as percent yield. The discussion is an interpretation of the results of the experiment. You will be given specific questions to answer which will show your understanding of the topic as well as what your collected data means.

If you have gotten results that are out of the ordinary, do not just ignore them. It is expected that you address these issues, not necessarily make excuses for sloppy work. For example, if you calculated a percent yield that is over 100%, give a hypothesis for what might have happened to result in this. You will be penalized more for ignoring errors than for taking responsibility for them.

Remember that whenever you use data from another source, such as a labmate's data or a published melting point, you must give credit to that source. For example: "Joe Smith's crude yield of acetaminophen is..." or "compared with the reported melting point of 169-170.5° C from the Merck Index..." would be the correct way of acknowledging where the data came from. Including data that is not yours without including your source is considered plagiarism.

We are now living in the 21<sup>st</sup> century, so do not turn in a hand-written report. While it is acceptable to hand write in any molecular structures, any text should be typed on a computer. Write concisely in full sentences using correct grammar. You must turn in a hard copy of all lab reports, e-mailed lab reports will not be accepted. Remember your lab report is due at the beginning of lab, one week from its completion.

### **III. Evaluation**

You will receive an evaluation grade each quarter from your TA based on your performance related to pre-laboratory assignments, technical skills, notebook preparation, housekeeping duties, general laboratory demeanor, participation during discussions sessions, etc.

### **IV. Lab Grade as Part of Your Course Grade**

The lab component of this course constitutes 25% of your overall course grade, and completion of all lab experiments and written reports is required to pass this course.

If you re-take this course in the future, you can use your lab grade again to avoid the need to redo the lab component of this course. However, you must have completed all lab assignments in order to take advantage of this option. Please contact me if this applies to you.