Chemistry 123: Principles of Chemistry **Carleton College**
Labs 52 and 57 **Lab Notebook Guidelines** **Winter 2003**

You are probably wondering, "What am I supposed to be writing in this stupid fancy book they made me buy?!?" Expectations for lab notebooks vary widely, so it is fair to expect some guidelines. Here they are.

Please note: What is written here applies to Rob's Chem 123 Lab sections, and may be considered heresy by other instructors and scientists. Please don't whip this page out to justify yourself to anyone except me!

What are Rob and the TA's looking for when they attack my lab notebook with their red pens?

- Does your lab book describe what you did in lab in sufficient detail that you could reproduce it *without referring to the red lab manual*? The terminology used in your lab book should be limited to things you understand at the time you write it. Sufficient detail should be given that *you* can use *your* lab book to perform the experiments or syntheses again and reproduce essentially the same results you report therein.
- Do you adequately describe what happened in lab? Specifically, did you record relevant observations like color changes, temperature changes, mistakes you made, defects in the equipment, and so on?
- Do you record "good data," that is, numbers labeled with their units, with a meaningful indication of their reliability **(significant figures and/or uncertainties)**, and a clear indication of what they are **(labels on data and clearly defined variables)**? "Mass of complex = m_c = 3.25 ± .01 g" is good. "3.2500000" is bad. Carrying through digits is even better, i.e. "Mass of complex = $m_c = 3.25_{45}$ ± .01 g" is extra-great!
- Do you follow proper lab notebook procedures with regard to legal and scientific integrity? This means producing a book that can not be altered by the removal or addition of pages, or the erasing and re-writing of text, without this being easily detected. You should number the pages in your lab book if they don't come already numbered. You must use a non-erasable pen when writing in your lab book. You must correct errors in such a manner that what was written before the correction was made can still be discerned. No White-Out™ or stuff like it, OK? Your lab book will not look perfect. That doesn't mean it has to be messy. See the example lab notebook pages accompanying this sheet for an idea of what this means.
- Is your lab notebook easy (possible?) to decipher in the hands of a trained scientist (like the TA's)? This requires that you write in a semi-logical manner, explain what that "16.4" written in the margin is supposed to mean, and write legibly. Good writing is important in science, especially in this respect!
- Are you "scientifically honest"? This means being careful about significant figures. It means attributing work done by someone else to that person, not making it sound like you did it. It means admitting up front when something goes wrong, like a synthesis not working or a calibration plot clearly being in error.
- **Do you understand what you are doing?** Lab is definitely the most difficult place to "fake it." If you don't know what you are doing or why you are doing it, ask us. Doing what your neighbor is doing, blindly, is a terribly dangerous thing to do in lab. Carrying out your calculations by doing "what someone else did" will work for a few cases, but it'll be pretty darn obvious that's what you are doing, before long.
- **Have you thought about the implications of what you observed in lab?** This is like, soooooo key, I am totally sure. If you get some groady orange product instead of the nifty blue stuff you think you were supposed to get, you should think about what you may have done differently than everyone else, and write your thoughts on the matter in your lab book. More generally, express your thoughts on lab in your book.

So, that's it, huh? It's all about my stinking lab notebook?

Nope. There are several other very very important things we consider in assigning lab grades:

- **Safety** – are you conscientious about your own safety and that of others? Do you follow safety rules?
- **Citizenship** – do you do what you can to help others and make the lab a fun and pleasant place to learn?
- **Teamwork** – do you work diligently and inclusively in the large number of group activities we do in lab?
- **Preparation** – do you arrive in lab having read the lab manual, and thus with some idea of what you're doing?

Here are some general pointers intended to keep you from making common mistakes:

1. Leave the first page or two of your book blank, and put a table of contents there. List the title of each lab and the page it starts on, so that it can be readily found.
2. It should be clear on what date something was written in your lab book. You don't have to date each page, but start each experiment with the date, and record the date when you go back to work on the experiment again, either in lab or when you are analyzing and writing up the experiment.
3. Start each lab with a general overview of what you are going to do, or attempt to do. Don't just explain what your hands were doing, explain what was going through your head.
4. If there is any sort of pre-lab work to do, do it in your lab book. All thinking associated with your lab should be done in your lab book, not on scratch paper!
5. Keep a **running account** of what you do in lab, as you do it. Write this directly into your lab book, as you do it. Do not write it in neatly later write it in NOW. The labs are designed to give you enough time to do this. Yes, it will slow you down. No, you won't do better by rewriting later.
6. Write at a level reflecting your current level of understanding. If something is new to you, describe it in simple terms. If you have done something many times before, use the appropriate scientific terms.
7. Write in the past tense. It doesn't have to be past imperfect, and it doesn't have to be impersonal. You can and should say "I" and "we." But you should record what you did in your lab book rather than what you planned to do. Reproducing your work requires knowing what you actually did. Thus with few exceptions (comments about ideas and the like) you should be writing in past tense.
8. Be clear about the people involved in a group project. Use their names in the running account. *Record in your book a clear and reproducible account of what **you** actually did, and what **you** actually saw.* Describe what others did and saw only in enough detail to allow someone to follow the entire process with all the relevant people's lab books before them. Don't make it possible to mistake someone else's actions or observations as your own: remember that a lab book is a testimonial!
9. Do not divvy up observational duties. Each person should make their own observations. But it is totally fine to divvy up experimental duties, like assembling an apparatus or massing something.
10. "Think out loud" in your lab book. Convey your hunches, hypotheses, and questions to the reader. If you have an "A Ha!" moment, explain what led you to your insight. If you find something difficult or frustrating, say so. If something is easier than you were led to expect it would be, tell us that.
11. Do your calculations *in your lab book*. Show your mistakes *in your lab book*. If we never see you screw up, we get suspicious and start worrying that you are an alien life form come to take us over.
12. When you make mistakes, cross them out such that they can still be read, then write the correct thing nearby. **Do not scribble out mistakes, or attempt to overwrite them.** If you mess up something big, even a full page, put a box around it, and then one or two lines between the corners of the box. **Do not remove the page or scribble it out!**
13. **Cite sources of information,** including other people, books you use, and the internet. The proper format for such citations is given in the following examples:
    a) Ellie Byrne told me that PET stands for polyethylene terephthalate, a polymer
    b) According to p. 56 of Zumdahl's, Chemistry, 5th Ed., Houghton Mifflin: Boston (2000), …
    c) According to the web site http://webbook.nist.gov/chemistry/, the molar mass of …