

Handout 1: Lab Notebooks: General Formatting

Information^{1,2,3}

Chemistry is a subject that often must be experienced first hand. Trying to learn the concepts of chemistry with out the laboratory is like looking through a cookbook without ever cooking or tasting food. Like cooking, to truly experience chemistry, you must get your hands wet to explore your world.

This lab manual has the same purpose as a general cookbook. It has tried and true recipes that will help you explore many of the concepts presented in class without experiencing the frustration of designing and implementing your own experiments. By following the instructions, you will find yourself sampling the basic flavors of chemistry. Chemistry, as in good cooking, requires observations, deductions, and conclusions. In addition, both require planning. You can't make a recipe if you do not have all the ingredients, proper tools, and do not understand the recipe. The same is true for chemistry. You need to come to class prepared, having read the assigned lab ahead of time.

Overall Format and Caveats

The labs have a standard format. The following format and guidelines are presented to help you be more successful in future lab classes. If you follow the guidelines, you should do fine. First, you will be recording all your labs in a carbonless lab notebook. This notebook is bound and has numbered pages. Before each lab class begins, you will read over the lab. All lab experiments are to be written in ink. Pencil is too soft to make legible marks on the carbon paper. Records and data for different experiments should be kept separate, i.e., all the data and the write-up of an experiment are kept together on consecutive papers. If you must begin a new experiment before the write up is complete, make a footnote in the lab book, and show the continued to page to account for the out-of-sequence pages. Don't leave any blank pages in your lab book.

Recording qualitative and quantitative observations (data) in a lab notebook can be messy. I guarantee that you will make some errors recording data. If you start with a neat, well-written purpose, introduction, and procedure, you will have an easier time following the lab and make fewer errors in the process.

- Errors in the notebook must be neatly crossed out, initialed, and dated.
- **Labs are done in ink, no exceptions.**
- **Don't use erasable ink and try to erase errors followed by re-writing over the erasure.**
- White out is not allowed. Also, do not rip out pages from the notebook.
- If you make major mistakes in writing procedures, draw an X and initial and date the page.
- Remember to use the cardboard backing sheet when you write in the notebook otherwise the writing is transferred to other sheets in the book and you end up wasting paper. Most students turn in the copy and it must be neat
- Any extra printouts should be trimmed to fit the notebook in such a way that there is at least half-inch border notebook page on each side of the attachment.
- Attachments are neatly trimmed and glued or taped into the book. Tape or glue all sides of the attachment down onto a blank page. Do not use staples; they are not permanent enough.
- You will need one copy for the original page and one that is turned in to me.
- Do not paste anything in the book sideways.
- Always use the portrait direction.
- **Begin each new experiment on a separate page!**

¹ Handout 1a) Common template for lab reports

² Handout 1b) Blank-pre-lab template

³ Handout 1c) Blank lab filled in

Format Overview

Pre-Lab Begins Here⁴:

HINT: Read the Pre-lab sheet and the instructions (at least 2 times) and take notes **BEFORE** you enter the pre-lab into your notebook. Your pre-lab will be neater, will be more coherent, and be an effective tool to complete the lab.

- 1) Title: The title should have the experiment number and use words to describe the experiment. Example: Experiment #8: Determination of the ionization constant of a weak acid. Yes! You can use the title in your lab manual.
- 2) Purpose⁵: Formulate the purpose by asking yourself, “Why am I doing this lab?” (“Because the teacher told me to.” is not an answer.) The purpose should answer the question “Why?” and express the intent of the experiment and should not be general education objectives such as, “to learn how to use a balance” or “to learn how to do statistical analysis.” For example, the purpose for a lab about density could be “to explore the concept of density by calculating the density of various objects using volumetric glassware and a balance” instead of “to learn how to use a balance or to learn how to measure density.” A good way to judge the specific purpose of the lab is to look at the calculations section of the instructions and the **pre-lab handout** for the lab.
- 3) Introduction⁶: The introduction is a summary of the procedure or method used to accomplish the lab. It should have the appropriate formulas and equations. Also, this is a good place to muse about the lab by including information from the textbook and lecture. The **pre-lab handout** will have helpful questions to lead you through this part of the lab. **Not all labs require introductions.** Read the **pre-lab handout** before you start writing. This will save you needless amounts of work.
- 4) Procedure⁷: The procedure is the step-by-step method to complete the lab. Any procedural point that requires an observation or a data collection point should be presented in this section of the lab report. One can omit the informational procedure points. Leave space between procedural points when outlining the procedure.

The Procedure section is divided into two columns: Column I, where the outline of the to be followed is written **BEFORE** lab, and Column II, where observations and data is recorded during the experiment. All quantitative observations should have units. The observations should be written across from the corresponding step in the procedure. Clearly label each part of the procedure.

Pre-Lab Ends Here

Lab Starts Here:

Data Entry and Observations

- 5) Data & Observation⁸: Once the lab begins, data and observations are recorded in Column II. Record data directly into the lab notebook, not on scraps of paper. Observations and data are recorded to reflect procedural points. There should be enough space to record all trials in a procedure without crowding. Remember, if an recording error occurs, cross out the error with one line. Initial the line (dating is encouraged!). Record data and observations in a logical and thorough manner. **DONOT FORGET SIG FIGS AND UNITS.** (It needed shouting!).

Do not underestimate how easy it is to forget data. Write in your lab book!

- 6) Data tables⁹: Once the lab is finished, the observations (quantitative and qualitative) are organized in a neat, easy to read, data table. This data is written in ink and includes information such as units, observations, unknown numbers, chemicals used, physical properties (to name a few). The data is readable and properly. Do not record data on scraps of paper. The data table is the extraction of pertinent information needed to

⁴How would I approach my first pre-lab

⁵ 2.1) How to write a purpose

⁶ 2.2) How to write an introduction, method

⁷ How to write a procedure etc

⁸ ibid Footnote 7

⁹ ibid Footnote 7

interpret the lab. The data/observation tables are clearly labeled to indicate from which part of the procedure the data was extracted.

Example:

Data	Trial 1	Trial 2	Trial 3
Wt bottle + sample	10.0000g	9.9990g	11.0000g
Bottle	8.9990g	7.0000g	9.9000g
Sample	1.0010g	2.9990g	1.1000g

- 6) Calculations: Many of the labs require manipulation of the data collected from the lab. Keep calculations separate from the data section. Calculations are neat and easy to follow. The calculations are labeled to reflect the parts of the procedure. Show **ALL** calculations in this section. Points will be deducted for calculations that are difficult to follow and/or contain sig fig errors and units errors.
- 7) Results table¹⁰: Summarize the results in a neat table. Include all the results and any unknown numbers. Again, the results table should reflect the data table and the calculations section.
- 8) Evaluation/discussion/error analysis/results statement¹¹: This section goes by many names. The evaluation section of the lab summarizes the results of the lab. This summary should agree with the purpose. Did you accomplish what you set out to do? “Yes, I did” or “I learned a lot in this lab” is not adequate. For example, if the purpose of the lab is **to determine the density of nickel metal using graphing techniques**, the evaluation might begin with **“The experimental density of unknownium, as determined by graphing was 6.7 g/mL.**

This is the section where errors, sources of errors and how they might affect the results, explain assumptions, and analysis the procedure are presented. For example, **reading the graduated cylinder such that the volumes were smaller than expected, would lead to a larger calculated density.** The summary should be based on the results of the lab work not, a subjective evaluation of the experiment.

Include comments in this section. For example, If the results are poor, or you have a large percentage of error, explain your source of error and evidence in your data. **The 12% error was due to problems reading the graduated cylinder. The volumes were not read consistently, leading to a decrease in the accuracy of the value. The errors in reading the volume made the experimental density higher than expected.**

Type the analysis and tape one copy into the lab book and one copy into the submitted lab. The evaluation should reflect good grammar and spelling. The results statement comments on the results and how they support the purpose; error is not discussed.

- 9) Questions¹²: Answer any questions that are assigned as part of the experiment. Answers to questions are typed; answers involving calculations can be done by hand.
- 10) Grading¹³: Evaluation will be based on the write up, quality of the results, and the answers to any questions that may be assigned. Pre-labs are check and sign (happy face or initial) every lab meeting. **NO PRE-LAB = CAN'T DO THE LAB!**

P. S.: Labs are not done in numerical order. You need to read the calendar and the agendas weekly.

WHEN YOU ARE READY TO TURN IN THE EXPERIMENT:

All lab reports need a well formulated purpose and introduction (when asked for), a clearly written procedure, the observation section filled in with pertinent information, a clearly developed data table when applicable, calculations that are easy to follow, a results table that summarizes calculated information, a typed evaluation of the results and any other questions or graphs that complete the assignment. This evaluation is TAPED into your book. Some specified labs will include typed summaries; the summary should include the evaluation of the results so you do either an evaluation or a summary. I announce the labs in class that require a summary and they are listed on the agendas and on the calendar. **WARNING: you must turn in your lab complete. If you forget a part, the whole lab is late.**

¹⁰ ibid Foot note 7

¹¹ How to write a discussion/summary/results statement

¹² How to answer questions

¹³ Report checklist