

## Topic 3: Keeping a Proper Lab Notebook

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### General Information

A laboratory notebook is critical to experimental research. It is a permanent, accurate record of each reaction and experiment that you perform. It will allow you and your peers to reproduce your results, design new experiments, write reports/papers, and/or determine where mistakes were made. Finally, if you were to develop a publishable/patentable idea, your lab notebook would be used as evidence that you developed the idea first. Keep in mind that while some organization and neatness is required, your primary goal is to record all procedures and observations accurately, not to have a "pretty" notebook.

### General Lab Notebook Guidelines

1. ***You must have your lab notebook with you at all times while you are working in the lab.*** It is better to be a few minutes late to lab than arrive on time but without your lab notebook.
2. ***Include a table of contents and number each page.*** Your table of contents should be in the inside flap of the cover or alternatively, you can reserve a few pages at the beginning of the notebook.
3. ***All entries must be made using permanent ink.*** Pencil is too easily erased. Waterproof and/or chemical resistant ink is strongly recommended.
4. ***Mistakes should be corrected by drawing a single line ~~threw~~ through them.*** Never scribble out mistakes or use whiteout.
5. ***Always write directly in your lab notebook.*** Never write information on loose paper with the intent of copying it over later.
6. ***Record your experimental details and data during the lab period.*** Certain information can and should be prepared prior to lab (e.g., title, date, reaction scheme, description, physical data for reagents, hazards, calculations, references, etc.), but experimental details must be recorded DURING the lab period. It is particularly important to note anything you did that was different than the described procedure (if you used slightly different amounts, added things in a different order, etc.).
7. ***Use past tense to describe what you did.*** This indicates that it was completed, rather than something you intend/intended to do.
8. ***Include all observations and measurements.*** For example, if it turned green and bubbled, be sure to mention that. If it had an uncorrected melting point of 95 °C note that (and also record the melting point apparatus you took the measurement on).

9. **Your lab notebook is a record of your work and your work alone.** Other people should not write in your notebook, and you should not include other people's work in your notebook. In the rare event that work done by a lab partner or teammate is important to include in your notebook, you must clearly indicate that the work was not done by you.

### Each Lab Notebook Entry Must Include...

1. **Your name.** Include your name on each page of notebook so that if your duplicate pages become separated, it is easy for the instructor to tell which pages belong to you.
2. **Descriptive Title.** Don't just title your experiments "Lab 1" or "First Lab". Include the title of the lab on each page that includes data for that lab.
3. **Date.** If you conduct a lab over more than one lab period, be sure to start a new page for each new day. The date at the top of the page should correspond to when the lab notebook entry was made.
4. **Course and section number.** Providing this information will keep your instructor happy.
5. **References.** Include any references you used during the prelab work and/or intend to use during the lab. This list should include lab handouts, Lehman, and/or the textbook.
6. **Prelab notebook preparation particular to lab.** This will vary from lab to lab, but will include things like a description, reaction scheme, physical data for reagents, hazards, and/or calculations.
7. **Detailed description of the experiment, observations, and any data/measurements.** You must include enough detail that a peer could reproduce (and verify) your results exactly. If this is done correctly, everything you need for your report will be in your lab notebook.
8. **Brief conclusion.** Indicate whether or not the experiment was successful and the major outcome (if known). One or two sentences are sufficient.

### Examples of Bad/Good Notebook Entries

**Bad:** Add HCl to the reaction.

**Better:** HCl was added to the reaction.

**Best:** 5 mL of 1.0 M HCl was added to the reaction.

**Bad:** Added about 3 g of sodium benzoate. Added some dichloromethane. Stirred.

**Better:** 3.02 g of sodium benzoate added to 10 mL of dichloromethane and stirred.

**Best:** To a round bottom flask was added 3.02 g of sodium benzoate and 10 mL of dichloromethane. The mixture was stirred until everything dissolved.

**Bad:** A color change was observed.

**Better:** The reaction quickly turned dark brown and cloudy.

**Best:** Within a few seconds the clear, colorless solution turned dark brown and cloudy.

**Bad:** An NMR was taken.

**Better:** An NMR sample in  $\text{CDCl}_3$  was taken. Three peaks were observed.

**Best:** An NMR sample was prepared using  $\text{CDCl}_3$  and taken using a 60 MHz Varian. Peaks were observed at 7.2-7.1 ppm (multiplet, 4H), 2.6 ppm (quartet, 2H), and 1.2 ppm (triplet, 3H).

**Bad:** The experiment didn't work.

**Better:** No benzoic acid was isolated.

**Best:** No product was isolated indicating that no benzoic acid was formed.

**Bad:** The experiment worked.

**Better:** Benzoic acid was successfully prepared.

**Best:** Benzoic acid was successfully prepared in 76% yield.

### References & Additional Resources

1. Lehman, J. W. *The Student's Lab Companion: Laboratory Techniques for Organic Chemistry*, 2nd ed.; Prentice Hall: Upper Saddle River, NJ, 2008; pp 36-37.
2. Zubrick, J. W. *The Organic Chem Lab Survival Manual*, 3<sup>rd</sup> ed.; John Wiley & Sons, Inc., New York, 1992, pp 327-328.