

Requirements for Experimental Notebooks

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(Dated: August 12, 2014)

Maintaining a laboratory notebook is one of the most important skills you will acquire in Junior Lab. A good notebook is essential when you begin to develop papers or oral presentations summarizing your experimental efforts. A detailed, real-time narrative that includes experimental schematics, plots of raw data, and details of your analysis will enable you to receive quick feedback and assistance from peers, lab staff, and instructors.

A poorly maintained notebook will prove immensely frustrating to you and your instructor. It is very difficult to answer questions like, “Why didn’t the experiment work” or, “Why was my result off by an order of magnitude?” without being able to clearly and easily trace your efforts using the notebook. *Don’t count on being able to recall any apparatus setting even one day after a lab session!* The following is a list of specific guidelines to follow when performing laboratory work.

Organization: *(overall quality and structure)*

1. **Create a descriptive table of contents** and make an entry every time you add new material. Title the TOC with the following:

Date _____ **Contents** _____ **Page** _____

Don’t use generic entries like “Day 1” or “Analysis”. Instead, produce records of significant milestones: *e.g.* “Plot of monochromator linearity over the visible spectrum”, or “Monte Carlo simulation of muon mean slant path distance”. Such descriptive headings will prove enormously useful later on when reviewing your notebook.

2. **Sign every page and date every entry** to demonstrate authenticity.
3. **Don’t ever erase**, use pencil, use white-out, or tear out pages of a lab notebook. Indicate “mistakes” by simply drawing a single, neat line through the item: they may prove to be not so incorrect as initially thought. Documented errors are useful as a guide to how the experiment was done and provide clues on how to better execute the experiment next time.
4. **Loose-leaf pages are never acceptable** within a lab notebook. Printouts generated by computer must be neatly taped into the notebook.
5. **Handwriting should be legible** to at least yourself, and ideally to others. The notebook *need not* be a linear narrative, but it should be **neat, compact, and orderly**.
6. If not completed online, preparatory questions and solutions should be written in your lab notebook.

Setup: *(things to do when starting each experiment)*

7. Following the preparatory work, **state the essential physics of the experiment in your own words**. List your experimental objectives and how they relate to the essential physics.
8. After listing the objectives, **identify the procedures you will have to perform**, the data you must obtain, and the required calibrations.
9. When starting a new experiment, **sketch a block diagram of the apparatus and signal chain**.

Experimental documentation: *(recording your work)*

10. **Record extensive narrative of your experimental work, in and out of lab**. Describe what you did, why you did it, what you saw, and what you did next. **Note typical instrument settings** so as to be able to quickly set up an experiment on subsequent days. **Sketch waveforms** at various places within the signal chain. This will help ensure your understanding of each component and permit you to rapidly identify equipment failure.
11. **Tabulate data into columns with headings, units, and estimated measurement uncertainties**. Tables of raw data are the core of your notebook, but it must be more than just a data log.
12. **Identify the location of large data files** or long analysis programs if they are too big to directly enter or tape into your notebook. Analysis scripts, functional forms for non-linear fits, *etc.* should always be present in your notebook.
13. Don’t wait until after the lab session has ended to visually examine the quality of your data. **Create hand drawn plots of data — with error bars — as they are acquired, not later**. These initial plots will inevitably save you time and frustration in making sure that your data are reasonable and suggestive of the behavior you expect. **★The importance of making preliminary plots and analyses in real time cannot be overstated.★**
14. **Your notebook should contain your analysis, results, and conclusions**. These should be documented with narrative, formulas, computations, plots, and error estimates, just like in-lab work. Remember to annotate graphics with as much information as possible about how they were created.

Bring your notebook to every lab session and to all oral exams. Failure to do so may result in penalties to your grade!