The Laboratory Notebook

PHYS 3719 - Class #2

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Physics Department
University of Utah

29th August 2006
Today’s program

Introduction

Format and Rules

Arrangement of an Experiment in the Notebook
The Laboratory Notebook

Introduction
- single most important piece of lab equipment
- (academic) poor record keeping ⇒ wasted time
- (industry) inadequate lab records ⇒ money
- (both) the notebook is a legal document that records your original work

Goal: produce a record of a scientific endeavor, understandable, and which can be used to repeat the experiment.

It should:
- say exactly what was done, and when;
- make clear who did it;
- enable someone else to do the same thing at some future date;
- be durable and verifiable.

Plain language!
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Rules:

▶ complete your experiments in the allotted time
▶ easier to write your laboratory reports

The basics:

▶ All work is to be kept in a laboratory notebook
▶ The pages are to be consecutively numbered
▶ No pages are ever to be removed
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General Rules (cont.)

- All entries are to be made directly in the notebook (ink)
- Everything recorded in an organized and neat manner
- Intelligible and understandable to the author and to any trained physicist who reads the records ("traceable")
- Anyone should be able to pick up your notebook and understand what you have written [Kanare]

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Unacceptable:

▶ rewrite (or “copy over”) an experiment in the notebook outside of the laboratory
▶ type up portions of the notebook in a word processor

Plan your activities in advance so that all information is properly entered into the notebook while you are in the lab.
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Include:

▶ a complete description of the work performed
▶ all reference materials consulted
▶ ideas related to the work

Remember:

▶ Never use intermediate scratch sheets.
▶ Graphs, charts, spectra, or spreadsheet analyses should be affixed to the pages of the notebook with tape or glue.
▶ Label the space where this material is to go with a description of the item and the results it contained.
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General Rules (cont.)

- On the first page are written the name of the class, your laboratory section, and your name.
- Use only the right side pages.
- If an error is made, draw a single horizontal line through the error so that it can still be read.
- Do not copy any information from the notebooks of former or current students.
- In general, the notebook should be arranged in chronological order.

Again, your notebook should be neat, orderly, and complete.
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► Title
► Purpose
► Introduction
► Theory
► Plan of Analysis
► Numerical Estimates
► References

Postreport:
► Experimental method
► Data
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Note: Sections should be clearly labeled.
The Prereport must be prepared **prior** to the lab period.

**Main contents:**

- statement of the property to be measured,
- results to be calculated, and
- how these are to be done.

**Two items are not discretionary [Baird]:**

- clear statement of the system and the experimental circumstances
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1. **Title**: experiment’s title, your name, and the date the experiment begun. Write the date unambiguously and include the year – for example 2nd July 2006.

2. **Purpose**: Clearly and concisely (two or three complete sentences) describe the purpose of the experiment. It may include the general method that will be used and anticipated results.

3. **Introduction**: history, background, and qualitative description of the experiment. This should be short and to the point.
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4. **Theory**: describe the model (complete to achieve the **Purpose** to the desired accuracy). It is important here to clearly state the assumptions made.

5. **Plan of Analysis**: what you are going to do. This section is a brief (not more than two pages long), but complete, description of the steps needed to carry out the experiment. Use simple, direct statements, or a bulleted or numbered list of steps or instructions. You may comment on any special feature of the material to be used.

6. **Numerical Estimates**: good handle on the expected results, check the feasibility of the proposed experiment. Evaluate whether the theoretical assumptions and the apparatus required are appropriate to achieve the desired accuracy and precision.

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Postreport

- This report does **not** need to be completed before you come to the lab, but you may want to prepare blank tables for recording data.
- Include in this section a listing of the reduced data (e.g. tables), all graphs, spreadsheet results, and spectra.
- Leave space for the graphs that will be prepared as part of the exercise.
- All data should be recorded in these sections in chronological order.
- Include all measurements made (with proper units and correct number of significant figures) and any important observations noted when performing the work.
- Avoid the overuse of personal pronouns.
- Observations are always written in complete sentences.
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Leave space for the graphs that will be prepared as part of the exercise.

All data should be recorded in these sections in chronological order.

Include all measurements made (with proper units and correct number of significant figures) and any important observations noted when performing the work.

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The use of tables will make it much easier for the reader to assess your methods and results.

Units, corrections, and information which make its interpretation meaningful should be carefully noted.

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Postreport Sections

1. **Experimental method**: written as each portion of the experiment is performed. The procedure should be as short as possible and still contain enough of the detail that another student could repeat your work.

   1.1 *Diagram*: an essential part of any good report. Drawings should be large enough to allow labeling. **Neatness** and **clarity** are important, and good, legible labeling assists enormously in understanding the experiment [Baird].

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2. **Data**: always including date, time, and signature. The observations that you make and the data that you record will lead to the acceptance or rejection of your hypothesis, and will decide what future experiments may be done. All the numbers must be written and their units indicated. The uncertainty for each type of measurement should be indicated.

Data is to be written directly into your laboratory notebook while performing the experiment. Your data in your laboratory notebook must (absolutely) be initialed by the instructor before leaving the laboratory.
2. **Data** (cont.):

- Data must be recorded honestly, as completely as possible, as you go along, in the notebook, in ink, immediately.
- Do not trust to memory.
- Do not use odd scraps of paper to record data.
- Raw data are **precious**.
- Use good penmanship.
- **Never** use white-out liquids.

2.1 **Tables**: each column being headed with the quantity, variable symbols, the appropriate units, significant figures, uncertainties, and the equation at the top of the columns for calculated values.

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3. **Results**: organized so that they can be easily assimilated and compared.

   3.1 **Graphs**: title, variables, units, labeled scales, data point symbols, error bars, and equation of best fit written clearly. Always plot the graphs by hand while taking data. Always include error bars.

   3.2 **Tables**: clear table of the data used to plot the graphs.

   3.3 **Calculations**: Illustrate all computations by writing the appropriate formula or equation, substituting a sample set of numbers (with units), and listing the answer to a correct number of significant figures. You may want to set up the calculations before coming to the lab to maximize your laboratory efficiency.

   If you made more than one measurement on the same phenomenon, calculate the average and standard deviation. When an accepted or theoretical value is available, calculate a percent error.

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4. **Discussion**: Summarize your results, compare them to the expected results and try to place them in context. It may only be two or three pages long.

4.1 *Comparison with theory*: (Whenever possible) compare with accepted or typical literature values. Assess whether the result is accurate. Comparisons must be made as quantitative as possible.

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4.3 *Improvements*: in the model, the experimental method, and/or the analysis of data. Identify what factors lead to a decrease or increase in accuracy. State what experimental methods or practices maximized the precision.

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4. **Conclusions**: In this section you provide an answer to the **Purpose**. Do not write things like “I like this lab,” “This lab went well,” or “This lab was successfully completed,” and do not overuse personal pronouns. Take your time and put some thought into your conclusions.
References


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