SCIENTIFIC WRITING: THE REU FINAL REPORT

Your experimental reports should be modeled on professional articles in the *American Journal of Physics* and the *Physical Review*, many examples of which are available online. A scientific report should be well organized and readable. Your goal is to present the essential ideas and important details concisely so that more people will read and understand your work.

A scientific report should be well written. Good grammar, complete sentences, well-formed paragraphs, accurate spelling, and proper punctuation are essential. Avoid sentence fragments and numbered outlines. For reference, the American Institute of Physics (AIP) style guide is available online at www.aip.org/pubservs/style/4thed/toc.html.

A useful book on scientific writing is *The Technical Writer's Handbook: Writing with Style and Clarity* by Matt Young (T11 .Y68 2002) available in the reference section of the Timken Science Library and by the printer in the Jr. I.S. lab. For clarity in writing, start with the entries on *gobbledygook*, *it*, *passive voice* and *wordiness*.

Reports do not all have to follow the same format, but most good scientific reports include a number of basic elements, which are discussed below. Scientific reports do usually use headings (such as ***Theory***, ***Procedure***, ***Results***, and so on) to give context to the reader.

Title

The title should be descriptive, with sufficient key words to attract a desired reader who might be searching a computer database.

Abstract

The abstract should state very concisely (usually in one paragraph) the scope and nature of the subject discussed, the basic method or approach, and a summary of the major results. Don't just say, "the speed of light was measured"; the reader wants to know what you measured it to be. The abstract should stand alone without reference to the rest of the paper, since many people will read only your abstract and not the full paper. See the entry on *abstract* in Young's book.

Introduction

The introduction should outline for the reader exactly what is to be discussed in the paper, the purpose of the work, and a brief history of previous work relevant to the investigation. Here the authors of an original research paper can describe what is new in their work and how it contributes to the field. See the entry on *getting started* in Young's book.

Theory

Experiments are designed and performed within a theoretical context. Describe this context here and summarize, motivate, or derive the relevant equations. **Equations should be treated like words in sentences.** They should not stand outside sentences, but should be punctuated as words inside the sentences, even when they are indented and numbered. Use superscripts for exponents in scientific notation. Be sure to explain what each symbol means. (Do not assume the reader knows what F or i is.) When referring to variables in a sentence, they are traditionally italicized (as in the previous parentheses). See the entries on *equations*, *the* and *symbols* in Young's book.

Procedure

Briefly describe what you did in full sentences and complete paragraphs. Don't write this section as a numbered list of steps, and don't imitate a lab manual. Use the past tense. Figures of the apparatus, including either schematics or digital photographs, are often valuable here; all figures should be numbered and captioned. Serial numbers of each piece of equipment are not necessary, but you should identify the major equipment used. This is also the place to describe experimental difficulties and how (or whether!) they were overcome and any corrections or calibrations which were used.

Results and Analysis

Concisely summarize your results and discuss them. (In some disciplines, *Results* and *Analysis* are expected to be two distinct sections.) This section will probably include plots and tables to display your results. **Plots and tables do not stand alone; each one must be discussed in the text.** Talk the reader through the important things to notice when looking at the figure.

All graphs, figures and tables must be labeled and captioned. Graphs must be titled, tables should have headings, and both should be labeled with units. Graphs and figures should be large enough to be clear; include error bars in your graphs. Graphs and tables should be on the page they are first mentioned or on the next page, not appended to the end of the report. **Verify that your results (including slopes of graphs) have proper units, the appropriate number of significant figures, and uncertainty estimates.** See the entries on *naked decimal point*, *SI units*, *kelvin*, *table* and *graph* in Young's book.

Conclusions or Summary

The structure of this section depends in part on the purpose of your experiment, whether your goal is the measurement of specific quantities, to determine which of two competing theories is correct, or to construct a device. Draw whatever conclusions you can based on your data. This may also involve a discussion of uncertainties. In some cases you may have to say that no conclusions can yet be drawn from your data. Suggestions for future research directions or possible improvements in the experiment are useful, since the REU report is often a progress report on a piece of a larger project.

Acknowledgments

If you borrowed apparatus from another laboratory, obtained ideas in discussions with others, or had financial support for part or all of your experiment, you should acknowledge such assistance here.

References

When you refer to previously published work, you should list the references in a section at the end of the paper. References are numbered in order of use in the text. Use the AIP reference style unless your advisor prefers a different reference style. You can also insert parenthetical arguments or comments here that would interrupt the flow of thought in the main body of the paper. Any quoted or paraphrased material used in your report must be referenced.

Appendixes

Supplementary material that would not be appropriate to put in the main body of the paper can be given in an appendix. Examples are lengthy derivations, details of uncertainty propagation, extensive tables of data, or computer programs.