

## Formal Laboratory Reports

**Unit:** Laboratory & Measurement

**NGSS Standards:** N/A

**MA Curriculum Frameworks (2006):** N/A

**AP Physics 1 Learning Objectives:** N/A

**Knowledge/Understanding:**

- Understand the purpose of a formal lab write-up, such as you would submit to a scientific journal

**Skills:**

- Write up an experiment formally in journal article format.

**Language Objectives:**

- Understand and correctly use the term “abstract,” as it pertains to a formal laboratory report.
- Understand and be able to describe the sections of a formal laboratory report, and which information goes in each section.

**Notes:**

A formal laboratory report serves the purpose of communicating the results of your experiment to other scientists outside of your laboratory or institution.

A formal report is a significant undertaking. In a research laboratory, you might submit as many as one or two articles to a scientific journal in a year. Some college professors require students to write their lab reports in journal article format.

The format of a formal journal article-style report is as follows:

Use this space for summary and/or additional notes.

### **Abstract**

This is the most important part of your report. It is a (maximum) 200-word executive summary of *everything* about your experiment—the procedure, results, analysis, and conclusions. In most scientific journals, the abstracts are searchable via the internet, so it needs to contain enough information to enable someone to find your abstract, and after reading it, to know enough about your experiment to determine whether or not to purchase a copy of the full article (which can sometimes cost \$100 or more). It also needs to be short enough that the person doing the search won't just say "TL; DR" ("Too Long; Didn't Read") and move on to the next abstract.

Because the abstract is a complete summary, it is always best to wait to write it until you have already written the rest of your report.

### **Introduction**

Your introduction is a short research paper on its own, with citations. (For a high school lab report, it should be 1–3 pages; for scientific journals, 5–10 pages is not uncommon.) Your introduction needs to describe background information that another scientist might not know, plus all of the background information that specifically led up to your experiment. Assume that your reader has a similar knowledge of physics as you, but does not know anything about this experiment. The introduction is usually the most time-consuming part of the report to write.

### **Materials and Methods**

This section combines both the background and procedure sections of an informal lab write-up. Unlike a lab notebook write-up, the Materials and Methods section of a formal report is written in paragraph form, in the past tense. Again, a labeled drawing of your apparatus is a necessary part of the section, but you need to *also* describe the set-up in the text.

Also unlike the lab notebook write-up, your Materials and Methods section needs to give some explanation of your choices of the values used for your control and independent variables.

Use this space for summary and/or additional notes.

### **Data and Observations**

This section is similar to the same section in the lab notebook write-up, except that:

1. You should present only data you actually recorded/measured in this section. (Calculated values are presented in the Discussion section.)
2. You need to *introduce* the data table. (This means you need to describe the important things someone should notice in the table first, and then say something like “Data are shown in Table 1.”)

Note that all figures and tables in the report need to be numbered consecutively.

### **Discussion**

This section is similar to the Analysis section in the lab notebook write-up, but with some important differences.

Your discussion is essentially a long essay discussing your results and what they mean. You need to introduce and present a table with your calculated values and your uncertainty. After presenting the table, you should discuss the results, uncertainties, and sources of uncertainty in detail. If your results relate to other experiments, you need to discuss the relationship and include citations for those other experiments.

Your discussion needs to include all of the formulas that you used as part of your discussion, but you do not need to show your work for each calculation.

### **Conclusions**

Your conclusions should start by presenting the same information that you included in the Conclusions section of an informal write-up. However, in a formal report, you should explicitly mention significant sources of uncertainty. Your conclusions should also suggest how future experiments might follow up on or expand on your experiment.

### **Works Cited**

As with a research paper, you need to include a complete list of bibliography entries for the references you cited in your introduction and/or discussion sections.

Use this space for summary and/or additional notes.