CP1 & honors (not AP®)

Formal Laboratory Reports

Unit: Laboratory & Measurement

NGSS Standards/MA Curriculum Frameworks (2016): SP3, SP8

AP® Physics 1 Learning Objectives/Essential Knowledge (2024): SP5

Mastery Objective(s): (Students will be able to…)

- Write a formal (journal article-style) laboratory report that appropriately communicates all of the necessary information.

Success Criteria:

- The report has the correct sections in the correct order.
- Each section contains the appropriate information.
- The report contains an abstract that conveys the appropriate amount of information.

Language Objectives:

- Understand and be able to describe the sections of a formal laboratory report, and which information goes in each section.
- Write a formal laboratory report with the correct information in each section.

Tier 2 Vocabulary: abstract

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 details of what to include are similar to the Internal Report format described in the previous section, except as noted below. The format of a formal journal article-style report is as follows:

Use this space for summary and/or additional notes:

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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 think "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 actually a mini research paper on its own, including 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 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 experimental design and procedure sections of an informal lab write-up. Unlike an informal write-up, the Materials and Methods section of a formal report is written in paragraph form, in the past tense, using the passive voice, and avoiding pronouns. As with the informal write-up, a labeled photograph or drawing of your apparatus is a necessary part of this section, but you need to *also* describe the set-up in the text.

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

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 that 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 separately and consecutively.

Use this space for summary and/or additional notes:

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Discussion

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

As with the rest of the formal report, your discussion must be in paragraph form. 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 each of the formulas that you used as part of your discussion and give the results of the calculations, but you do not need to show the intermediate step of substituting the numbers into the equation.

Conclusions

Your conclusions are written much like in the internal write-up. You need at least two paragraphs. In the first, restate your findings and summarize the significant sources of uncertainty. In the second paragraph, list and explain improvements and/or follow-up experiments that you suggest.

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.

Your ELA teachers probably require MLA-style citations; scientific papers typically use APA style. However, in a high school physics class, while it is important that you know which information needs to be cited and *what* information needs to go into each citation, you may use any format you like as long as you use it correctly and consistently.

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Typesetting Superscripts and Subscripts

Because formal laboratory reports need to be typed, and because physics uses superscripts and subscripts extensively, it is important to know how to typeset superscripts and subscripts.

You can make use of the following shortcuts:

superscript: text that is raised above the line, such as the exponent "2" in $A = \pi r^2$.

In Google Docs, select the text, then hold down "Ctrl" and press the "." (period) key.

In Microsoft programs (such as Word) running on Windows, select the text, then hold down "Ctrl" and "Shift" and press the "+" key.

On a Macintosh, select the text, then hold down "Command" and "Control" and press the "+" key.

subscript: text that is lowered below the line, such as the "o" in $x = x_o + v_o t$.

In Google Docs, select the text, then hold down "Ctrl" and press the "," (comma) key.

In Microsoft programs (such as Word) running on Windows, select the text, then hold down "Ctrl" and press the "–" key.

On a Macintosh, select the text, then hold down "Command" and "Control" and press the "–" key.

Note that you will lose credit in laboratory reports if you don't use superscripts and subscripts correctly. For example, you will lose credit if you type *d* = *vot* + 1/2*at*^2 instead of $d = v_o t + \frac{1}{2} a t^2$.

Use this space for summary and/or additional notes: