Style Guide for Physics Lab Manuals

This is a style guide for the lab manuals of the Boise State University Physics Department. The guide provides structure and formatting directions for the department's 101, 111, 112, 211, 212 and 309 manuals. For PHYS 101 and PHYS 309, there are a handful of differences described in their respective sections at the end of the guide.

This guide assumes access to Microsoft Word 365 and MathType. Other software may or may not have functionality which can substitute for the features available in Microsoft Word and MathType.

Overall Lab Manual Structure

Include a **Cover Page** followed by a **Table of Contents**. A **Foreword** may be inserted after the **Table of Contents**. Begin each **Lab Exercise** on a new page. An **Appendix** may be included after the **Lab Exercises**.

Individual Lab Exercise Structure

Lab exercises are organized into four sections**: Introduction**, **Procedure**, **Group Report** and **Lab Maintenance**. These sections are detailed below along with their sub-sections.

The **Introduction** provides students with the information they need to understand the experiment and is divided into the sub-sections **Objective**, **Theory** and **Apparatus**.

- In the **Objective**, the goal of the experiment is summarized in a sentence or two.
- In the **Theory**, the underlying principles the experiment is based on are explained. This should include relevant mathematical expressions and equations needed for calculations.
    - The **Theory** can be split into multiple sections, some of which aren't necessarily theory-based. Use the Heading 3 style for each of them, and title theory-based headings as "Theory: X".
- In the **Apparatus**, the equipment needed to conduct the experiment is listed.
    - The equipment should be bulleted in a borderless three-column table. Use one cell for each item.
    - Use 0.2" top and bottom cell margins and the default 0.8" left and right cell margins. Use 0" indent for bullets and 0.25" indent for bullet text.
    - Notes about equipment should be included with a caption under the table. Use 6 pt. spacing between the caption and table. For one caption, indicate the item with an asterisk. For multiple captions, indicate each item with a superscript number (e.g. "[1]").

The **Procedure** details how to conduct the experiment step by step. It may be divided into multiple parts.

- Each part should be labeled as "Part X" with X being the part number. Follow with a dash and a descriptive name.
- Number steps continuously between parts. First level numbering should use the style "1." and second level numbering should use the style "a."

- Include tips and extra information for the exercise as tagged notes for students. Use the tags "important", "equipment", "tip", "report", and "note". Begin with the tag type and a colon bolded and italicize the tag and the following text. Use the same indentation for the tags as the numbered steps. For steps with multiple tags, list them in order of important, equipment, tip, note, report. As an example, see the tags below.

Tip: *This is a tag.*

Report: *Suggestions for improvements to this style guide should be included in an email or Slack message.*

- Most questions for the group report should be listed in the **Group Report** section, however, for questions which should be answered during the lab exercise, list them after the appropriate step with formatting similar to a tag, like so:

Q1 What is the worst part about editing lab manuals? Explain.

The **Group Report** section explains what data is required in a **Data** section and gives questions the students must answer in the **Questions** section.

- Start with the explanatory text: "*One report should be handed in for each group. Include each group member's name, the lab number, the lab section and the instructor's name. Include all plots, calculations and data tables in the report."*
- In the **Data** section, a summary of the required data is given using a numbered list and empty data table templates.
    - The first level of the list should use the style "A." and the second level should use the style "i."
    - Reference which step each piece of data needs to be measured.
    - Empty data tables should be given following the bullet that describes the data which should be recorded in the table. Center the table. Use 0.2" spacing top and bottom for each cell.

      Important: *Don't forget to include units in the column headings!*
- In the **Questions** section, the questions the students must answer in their group reports are given.
    - Start with the explanatory text: "*Give answers in complete sentences with a restatement or description of the question."*
    - Reference pertinent steps from the Procedure.

The **Lab Maintenance** section details specific cleanup requirements the students should complete before leaving for the day. Begin with the message: "Remember to organize your lab station and save a copy of your group report before leaving for the day. Delete any files created during lab."

The overall ordering for sections and sub-section headings is: **Introduction**, **Objectives**, **Theory**, **Apparatus**, **Procedure**, **Group Report**, **Data**, **Questions**, **Lab Maintenance**.

Additional Formatting

Text

Use the Styles feature in Microsoft Word to save specific formatting as Heading 1, Heading 2, etc.

Font

- Titles in 16 pt font. (Heading 1)
- Headings (Heading 2), subheadings (Heading 3) and text in 12 pt font.
- Headings (Heading 2), should have a bottom border ½ pt. thick offset from the text 6 pt.
- Arial font for titles and headings.
- Times New Roman font for subheadings and text.
- Never use ALL CAPS unless students are in imminent peril.
- Explanatory text at the beginning of a section should be italicized.

Spacing & Alignment

- Left-align all headings.
- Use 12 pt. before and after spacing for headings, subheadings, explanatory text, in-line images, and around tables and "display" mode equations.
- No indent on first paragraph, 0.25" indent on subsequent paragraphs. No spacing between paragraphs.

  Note: *This makes it easier to identify paragraphs in the* ***Theory*** *section.*
- Use 6 pt. before and after spacing for lists
- No indents on first level of lists.
- For sub-levels on lists, adjust indents for the bullet and text to line up with the previous level.
  - Like this.

Table of Contents

- Use the Table of Contents feature on the Reference tab in Microsoft Word.
- Display page numbers for the **Foreword**, beginnings of **Lab Exercises** and beginnings of **Appendix sections**.

Images

- Apply a ¾ pt black outline and an outer shadow offset to the bottom right.
- Use square wrapping in most cases. Keep the images within the text margins.

  Tip: *Displaying gridlines is useful for keeping images within the margins.*
- Center images wrapped in line with the text.

- Images which need to be referred to later may be labeled as Fig. 1, Fig. 2 etc. Put the image in line with the text and center it. Center the caption below the image with 12 pt. after spacing. Remove any spacing between the image and caption.

Equations & Symbols

- Use the equation editor in display mode for equations not in-line with the text and in linear mode for equations in-line with the text.
- Display numbered equations in a 3-column table. Use the options in Table Properties to set the width of the table to 100% and the width of the columns to 10%, 80% and 10%. Right-align the number in the third column and center it vertically in the cell.
- If MathType is not an option, Microsoft Word's equation editor can be used instead. Include punctuation within the equation like so.

  Example. (1)

  Important: *Do not include any additional characters in the middle cell with the equation. Microsoft Word 365 does not provide the option of putting equations into "display" mode if another character is on the same line. Unfortunately, punctuation can only be included within the equation itself.*

  Note: *Cambria Math is the only math font in Word by default. Other fonts such as XITS or STIX Two can be found online. The overall quality of the fonts is significantly worse than Cambria, though.*

- Ideally, MathType should be used to generate equations as its version of Times New Roman very closely resembles that of Word. Equations will otherwise look out of place, and symbols will look different between the text and equations.
- Refer to equations in the text as Eq. (1), Eqs. (2) & (3), etc.
- Italicize variables used in the text.
- Don't include symbols or expressions in-line with the text which have a greater height than the text height.

Page Numbering

- The **Table of Contents** and **Foreword** should be numbered separately with lowercase Roman numerals.

  Tip: *Go to the Layout tab and select the Breaks drop-down to insert a section break. This allows numbering separately for different sections. Make sure to disable Link to Previous for the header and footer following the section break.*

- Regular numbering should begin with first **Lab Exercise**.
- Use left-aligned page numbers on even pages and right-aligned page numbers on odd pages. Treat the **Table of Contents** as the first page, not the cover page.
- For even pages, add the title of the manual as "*Cooperative Exercises in Physics: PHYS XXXL"*.
- For odd pages, use Quick Parts to add a StyleRef to Heading 1. Italicize the text. This will display the current lab exercise or appendix section in the header.

- For both even and odd page headers, add a bolded vertical bar between the page number and text, as well as a bottom border and White, Background 1, Darker 5% shading. Also add a space on either side of the bar.
- Use a bottom border in the header with 1 pt. thickness. Change the color of the border and the bar to "Black, Text 1, Lighter 50%".

Miscellaneous

- References to a section should be capitalized: "the Theory", "refer to Steps 1-4", "in Part 2".
- Include special messages and warnings for students in bold text with a box outline and White, Background 1, Darker 5% shading. Center the text.

This is a special message.
WARNING: Don't overdo it.

Writing Style

The following are guidelines for writing style.

- Use third-person pronouns in the Procedure and Data sections.
- Keep descriptions and explanations brief and direct, particularly in the Procedure. Begin with the main point rather than starting with theoretical analysis.
- Technical language should be explained and used sparingly. Use terms and symbols familiar to students whenever possible. In particular, use concrete terms instead of references to theoretical models unless necessary.
- Confine use of italics, bolding and underlines to consistently defined formatting as much as possible. This reduces student confusion and enhances the impact of special casing when it is justified.
- Use context. Avoid saying the same thing twice and take advantage of the formatting & structure. For example, the phrase "In this lab" should be avoided because it is almost always clear which lab is being talking about.

PHYS 309

By the time they reach PHYS 309, students should be familiar with operating basic equipment and completing reports and laboratory exercises. Because of this, some things should be omitted from the 309 manual and a handful of things should be added or modified.

- Omit sample data tables. Leave the design of data tables as an exercise to the students 😊.
- Omit the **Group Report** and **Questions** messages and add the following message for the Data section: *"All data and calculated values should be organized with data tables. Remember to label and scale plots appropriately and include units."*
- Add a **References** section at the end of the **Group Report** section for additional materials students need to complete the lab exercise.
- Omit the **Lab Maintenance** section.

- Omit report tags. Included fewer tags in general
- Keep **Procedure** descriptions brief and use technical language to challenge students to interpret what the exercise asks of them. Be careful to avoid ambiguous language, though.

PHYS 101

The audience for PHYS 101 is different from other physics labs. Lab exercises should avoid technical language and encourage exploration throughout the exercise.

- Write the Procedure in second person.
- Group report requirements should be covered over the course of the procedure. Use the tags “Q#”, “Data”, “Graph”, “Figure”, and “Report”, if necessary. Bold the tag but don’t italicize the text.
- Omit the Group Report section.