PHYS 232 – Formal Report Guidelines

Preliminaries:
Assume the report will be read by a physics undergraduate from another institution that has the same level of physics training as you. The reader is familiar with undergraduate physics, but has never done the experiment that you are describing. The reader is interested in understanding what you did, how you did it, and why what you did is interesting. Reports should be neat, legible, and free of grammatical and spelling errors. The page limit for your report, including the coversheet, all figures and tables, and citations is **8 pages**.

Cover Page:

The first page should indicate the title of the report, the author, the name of the lab partner, and the date. It should also include a one paragraph abstract that provides a outlines the purpose of the experiment, the experimental technique used, and a summary of the key results (give numerical values).

Introduction:

An introductory section should clearly state the objective of the experiment and should discuss the theory, introducing any relevant concepts and equations. While it is not usually necessary to re-derive equations appearing in the lab manual or in a text, you should make sure that you introduce all of the relevant physics and discuss any approximations or conditions that apply to the equations you have introduced. All key theoretical predictions should be discussed at this point. It is better not to refer to the special apparatus at this point unless you are prepared to describe it in detail, because you are to assume the reader has not seen the apparatus before. You must properly cite all references used. If you're working from reference materials (very likely), you must rephrase this material using your own words.

Procedure:

This section should describe the apparatus and methods in a manner complete enough so that a reader who has never seen the apparatus can understand what you did and why you did it. In each step it should be clear how that step helped you measure a quantity necessary to achieve your objectives or minimize and/or assess error in measurements. In most reports, a diagram of the set-up will be required. In this section, you should describe what you actually did, not what the lab manual said you should do. Thus sentences will typically begin with "We measured the..." rather than "You measure...." That is, you should write about what you did in the past tense. If you repeated a measurement several times, which is usually a good thing to do, indicate that. Finally, explain why you did what you did. Put another way, the purpose of this section is to tell the reader how you acquired your data.

Results and Discussion:

The results section should include all of your raw data as well as any useful quantities you have derived from it. However, it is not necessary or useful to present large tables of data. Large collections of data are best displayed in graphical form. Make sure that all units are included, appropriate significant figures are used, and error estimates are included. Finally, this section is designed to be read, it is not just a collection of numbers, equations and graphs. Include sufficient text so that the reader understands the significance and the context for all that you show. This section should also include a discussion of your results and a numerical error analysis.

Conclusion:

In the final section you should draw conclusions from your results. Refer back to your introduction and discuss whether or not your objective was met. Include here a discussion of the discrepancy between theory and experiment. If necessary, conclude with a discussion of how the experiment might be better performed. In deciding whether or not a given theory has been verified, it is important to take into account the numerical uncertainties you have calculated. It does not matter whatsoever if theory and experiment agree to within 10%, 1% or 0.1%, so don't report this kind of analysis. What matters is if they agree to within the anticipated uncertainty you have calculated.

$\star\star\star$ THIS GIVES AN OUTLINE OF A TYPICAL FORMAL REPORT ONLY. YOU DO NOT HAVE TO ADHERE TO THIS STRUCTURE EXACTLY. FORMAT YOUR REPORT AS YOU SEE FIT. $\star\star\star$

Marking Scheme

/2 MECHANICS
Title Page/Abstract
Grammar, Legibility

/4 INTRODUCTION
Objective
Theory

/4 PROCEDURE
Clarity of Explanation
Correctness

/8 RESULTS
Presentation
Accuracy of Measurements
Completeness of Calculations
Discussion of Results

/2 CONCLUSIONS
Connection to Objectives

/1 ERROR ANALYSIS MULTIPLIER

/20 TOTAL

The TOTAL is calculated as:

TOTAL = Mechanics + Introduction + Procedure +...
...(Error Analysis Multiplier)×(Results + Conclusions)

Common Mistakes

Here's a list of some common mistakes made by students writing formal reports. Please avoid these problems. Failure to do so will lead to additional deductions from your total score.

- In a technical document, variables should be in italics to differentiate them from regular text. So, for example, your report might say something like, "Relativistic momentum p and energy E are related via $E^2 = (pc)^2 + (m_0c^2)^2$, where m_0 is the rest mass of the relativistic object and c is the vacuum speed of light." Also, vectors need to be distinguished from scalars. Usually, vectors are bold face symbols, like the electric field $\mathbf{E}$, but $\vec{E}$ is acceptable too.

- Make proper use of significant figures. For example, suppose that, based on your experimental data, you calculate $\hbar = 1.1256 \times 10^{-34}\,\mathrm{J\,s}$ and $\Delta\hbar = 4.37 \times 10^{-35}\,\mathrm{J\,s}$. Do not report this number as $\hbar = 1.1256 \times 10^{-34} \pm 4.37 \times 10^{-35}\,\mathrm{J\,s}$. This is poorly formatted and does does not make use of proper significant figures. Report this number as $\hbar = (1.1 \pm 0.4) \times 10^{-34}\,\mathrm{J\,s}$. That is, write the number and its error using a common power of ten multiplier and keep only one significant in the uncertainty. If the first digit in the uncertainty is a one, then it is common to keep two significant figures in the error value. So, for example, if $\Delta\hbar = 1.37 \times 10^{-35}\,\mathrm{J\,s}$, then one could report $\hbar = (1.13 \pm 0.14) \times 10^{-34}\,\mathrm{J\,s}$.

- Although variables are in italics, units are not. Also, there is a space between a number at its unit.

- Every figure and/or table used requires a number and a caption. For example, a figure caption might read something like: "Figure 1: Plot of the entropy of the spin system as a function of temperature."

- All figures and/or plots must be referred to in the text. For example, the text within the body of your report might read: "The experimental data that were acquired are displayed in Fig. 1."

- You may also receive deductions for missing citations, improper formatting of citations, and/or low-quality citations (i.e. a bunch of websites). Make an effort to cite relevant books and papers.