Formal Laboratory Write-Ups:

- These ***are due in the next lab class or one (1) week from the time the lab is performed***.
- If there is a week that we do not meet for lab, ***the lab is due no later than noon on the Thursday following the completion of the lab exercise***.
- Late formal lab reports will be accepted. If a formal lab report is not handed in during the laboratory period (or by noon if we do not meet for lab) it will be considered late and ***six (6) points per day will be deducted from the score*** received on the lab. ***This includes weekends***.
- ***Abstract***: Brief statement of the method used and the results obtained with uncertainties and comparisons to accepted values (if applicable).
- ***Introduction/Historical Background***: Discuss motivation for the experiment. This section serves primarily to help the reader understand the significance of the experiment and all the issues that are later addressed. The main questions to be addressed in this section of the report are "Why are you doing this experiment?" and "What do you hope to find?" (Please note that "We're doing this experiment to illustrate the concepts discussed in class," while true, is not an adequate answer to the first question. When writing the report, pretend that you have chosen to do the experiment of your own free will, motivated by scientific curiosity, rather than having the experiment forced upon you by the inhuman taskmasters of the Physics Department.)

  Many of the labs we will do this term are recreations of experiments that were crucial to the development of physics. For these labs you should include a section placing the experiment in its historical context. In particular, discuss when the experiment first took place, the prevailing physics ideas related to the experiment, how the results were interpreted, and what effect the experiment had on the physics of the time.
- ***Theory***: If the experiment is designed to test a particular physical theory discussed in class, you should explain in sufficient detail both the general theory and the particular prediction you're attempting to check in the Introduction. You do not need to supply every step of a particular derivation. (It suffices to say, for example, taking equation 2, we multiply by 2, solve for the variable x and substitute the result into equation 1.) This section is often the most difficult to write, and you may want to try writing this section last, since you want to be sure to introduce any important concepts that are needed for your discussion in later sections.
- ***Procedure***: Describe your set-up (drawings are usually needed) and the method used. Do not just restructure the instructions in the lab hand-out, and do not assume that your reader has read the lab hand-out. Make sure you describe the apparatus before referring to parts of it. A Procedure section which starts out "We moved the cart back and forth on the track and recorded the position with the sensor" will be incomprehensible to a reader who was not in your class. You need to tell the reader that the apparatus consisted of a cart, a track, and a sensor, and also what kind of cart, track, and sensor you used. Including a sketch of the apparatus is not sufficient description; you must also describe the apparatus briefly in words.

- ***Results***: Present your data and calculations. This is the meat of your report. First present the raw data. Numerical data should be listed in a table and the table referred to in the text; graphical data (for example, position vs. time plots from Science Workshop) should be presented as figures and referred to in the text. Be sure to include uncertainties in any measured quantities.

  After presenting the raw data, discuss any calculations that you made from that data. If there are results of calculations that would be best presented in a table, make sure they are clearly distinguishable from the raw data, either by putting the processed data in a separate table, or by clearly labeling the columns. If there are results that would be best presented in a figure, label the figure clearly, and be sure to refer to it in the text. Be sure to label the tables and figures and to refer to them in the text by name (e.g. "Figure 1", "Table 2"). Don't include a figure without discussing it in the text. Explain the relevance of the figure, and what it tells you about the experiment.

  Discuss your errors in this section. Discuss the sources of error, both random and systematic, and how the errors affect your results. Do not put off the discussion of the error until the Conclusion section.
- ***Discussion/Conclusion***: If there are further interpretations of the results or significant implications to be discussed, such a discussion should occur in this section. You must also summarize the main results of the experiment.

  This is where you should discuss the implications of the comparison between experiment and theory (Does your measurement agree with the theoretical prediction? If so, what does that tell you? If not, why not?) , or between two different methods of measurement (If you measured the same quantity in two different ways, which measurement was more accurate?). Address any additional ideas you have about the experiment, such as improvements that could be made, or how the experiment relates to the material discussed in class.

Additional Comments:

- All numbers in Physics need to have units attached.
- All equations need to be typed, have an equation number (Word has a built-in equation editor) and be referred to by that number in the text of the report. Do not hand-write equations.
- All graphs need to have a descriptive title, a figure number with caption, and the axes need to be labeled.
- All graphs and tables need to be in the body of the text, not attached at the end of the report.
- Grammar and spelling count.
- The lab report should look something like a scientific paper submitted for consideration of publication.
- Assume that the reader of your report has neither a lab handout nor knows anything about the topic you performed.
- DO NOT include subjective statements about your feelings or thoughts in the lab report. For example, don't write "This lab was sort of hard for me" or "I learned a lot in this lab" or "our results were pretty good".

Additional Comments continued:

- DO NOT use the term “human error”. It is a vague “catch-all” which doesn’t convey any useful information. When you discuss errors and uncertainties, try to be as specific as possible. Vague expressions like “pretty good” and “close enough” are to be avoided. If you can compare your result with an expected or accepted value, note whether the expected value falls within the experimental range predicted. If it doesn’t, try to track down where the problem lies and describe your findings in the discussion. NEVER attribute lack of agreement to calculation error!
- Lab reports need to be written in a clear, logical, succinct manner and contain sufficient detail so that the reader understands what you have done.
- Lab topics, or variations of lab topics, may be tested on in-class exams.
- To get the highest grade possible, you need to demonstrate a clear mastery of the topic at hand. It is not simply enough just to report on only what the lab handout asks. You need to suggest further experiments that could be done. Perform additional calculations/extensions of the experiment that could be reasonably expected.
- Since the report is a record of what you did, it should be in the past tense.
- Do not wait until the night before the lab is due to start writing it.
- Come and see me often for help.