Lab Report Rubric — Phys 123 — Fall 2017

Keith Pedersen (TA) kpeders1@hawk.iit.edu

____/20

1. **Required: signed data sheet**
   (a) **You *must* have a signed data sheet to get *any* points.**
      i. Attach your data sheet to the back of your report (see "General: Properly connected").
2. **General (2 pts.)**
   (a) **[+1] Properly identified.**
      i. Your **name** (***Surname***, ***First name***) and **lab section** (**123-L03** of **123-L04**) goes at the ***top right***. The **lab #** (e.g. ***Lab 3***) is centered at the top. A cover-sheet isn't necessary.
   (b) **[+1] Properly connected (stapled).**
      i. Your lab should not fall apart in my stack. You must ***staple*** all parts of your lab report together (no paperclips, and definitely ***don't use the fold and tear trick***).
3. **Introduction (3 pts.)**
   (a) **[+2] Outline your goal.**
      i. A lab report is an argument towards a scientific conclusion. Properly discuss the theory behind your argument, then briefly talk about how you intend to support it. Be clear and concise. ***DO NOT PARAPHRASE THE LAB MANUAL VERBATIM!***
   (b) **[+1] Present equations, *number* them, and refer to them by their number.**
      i. Scientific conclusions are expressed ***quantitatively*** (with numbers), so you'll need to use equations to churn your raw data into a final product. ***All equations*** must be presented in the Introduction. Each equation should be on its own indented line, with a line above and below (to separate it from the text). You must also ***cite their source*** in the References.
      ii. You must explain what the ***symbols*** in each equation represent — don't assume I know.
      iii. Only include equations that you ***actually use*** in your analysis (i.e. don't include the first 5 equations from a derivation if you only use the final equation in your report).
      iv. ***Number*** your equations (in the order they appear in ***your report***) so you can easily refer to them in your Results and Discussion. The number should come ***after*** the equation (with some tabs for spacing) and be ***wrapped in parentheses*** (see my template on online).
4. **Experimental Methods (4 pts.)** ***NO FIRST PERSON*** (I, we, my, he, she, ...)
   (a) **[+2] Describe your experiment in sufficient detail for reproduction.**
      i. Scientific results must be repeatable! Describe ***what you actually did*** in lab well enough that you could re-run your experiment a year from now. This should be a ***narrative*** in the past tense; it's the story of your data taking, not instructions for others. You should assume that your future self only has the apparatus, not the actual lab manual. This means you must explain ***how*** and ***why*** you did each step (unless it's completely self-evident).
   (b) **[+2] How did you address error while taking data?**
      i. Report ***specific ways*** you adjusted your apparatus or methodology to minimize error (either observed or imagined). Explain that these actions were done in an attempt to reduce error.
      ii. ***Do not*** simply list "possible" sources of error; it is too easy to make them up after the fact. I want to know that you were thinking about error while you were taking data.
      iii. Taking ***3 trials*** for each measurement is ***expected***, and will not count towards these points.

5. **Results and Discussion (9 pts.)**

   (a) **[+5] Analyze and present your results effectively.**

      i. Scientific results are always ***quantitative***; you'll need to use a graph or table.

         A. Only show the reader ***the finished product*** (the graph); don't create tables of your raw data unless it is somehow furthers your argument.

         B. Graphs and tables should never be split across two pages; this is illegible.

      ii. If your results ***can*** be graphed, they ***should*** be graphed. Tables have their place, but a reader can stare at a graph for 3 seconds and learn more than if they'd stared at a table for 3 minutes. Every report (except perhaps lab 9) should have at least one graph.

      iii. ***Label everything!*** A graph should have a title, and its axes should be ***labeled with units***. A table should also have a title, and each column and row should have its own label (with the ***units in the labels***, not after each individual number).

      iv. A graph offers nothing quantitative without a ***fit line***, but a fit line offers nothing quantitative unless you ***show the fit line equation*** and R^2 (large enough to be legible).

         A. Every result in this course can be attained using a ***liner fit line*** (nothing fancy).

         B. ***Do not*** set the y-intercept to zero! This will give you a worse fit (a smaller R^2), and you will lose important error information embedded in the y-intercept.

      v. You results (especially your fit line equation) shouldn't have ***more sig. figs.*** than your data.

      vi. If I am confused by your results, then you haven't made an effective argument.

      vii. Your report is ***your responsibility***; if it's illegible, it's not "the printer's fault".

   (b) **[+3] Discuss quantitative results (the numbers which support your argument)**

      i. What do your analyzed results (the numbers) mean? Does the theoretical model fit your data (i.e. does your fit line have an acceptable R^2)? If it doesn't, is a better model needed?

      ii. Your primary results are the slope ***and*** intercept of your fit lines — you need to discuss them. They both represent a physical quantity (like the mass or density of your system), so explain what the theory predicts and ***compare quantitatively*** to your actual results.

         A. Discuss your results as ***numbers with units***: "We measured $g = 8.70\ \mathrm{m/s^2}$."

         B. All comparisons between your results and theoretical predictions should be ***quantitative*** (like relative difference, see the Quick Reference). Words like "similar" and "close" are qualitative, and should only be used to ***assist*** a quantitative comparison.

   (c) **[+1] Discuss quantitative errors**

      i. The self-consistency of your measurements will be reduced by ***random errors***, which can be quantified via standard deviation and the coefficient of variation.

      ii. The consistency between your results and the measurements of other scientists will be decreased by ***systematic errors*** (like friction), which can be quantified via % systematic error.

6. **Conlusion (1 pt.)**

   (a) **[+1] Summarize**

      i. Your conclusion should be a short synopsis, two paragraphs max. It should only ***restate*** findings you've already presented in previous sections. The only ***new content*** should be lessons learned (e.g. what you would do in the future). This is the only section where you can use the first person.

7. **References (1 pt.)**

   (a) **[+1] Cite your references in the APA style**

      i. Any sources you used to find facts, ***equations***, ideas, or figures (including the lab manual) should be cited. Citations to websites ***must include their URL***. For a tutorial on APA style, Google: "APA Cornell".