Lab Grading Standards for Spring 2024 ***pending your input!**

Each PHYS 106 lab contains two parts: ***guided* inquiry**, where we introduce you to the systems available for the week, and ***independent* inquiry**, where we require you to do something that we have not specifically required you to do (*i.e.*, you are expected to do science, pertaining to the current topics at hand, using the particular systems available for the week).

Pseudo-Notebooks:
For the first part, guided inquiry, we provide "*lab procedurals*" that should be viewed, in part, as simple guides to the sorts of habits of mind and work that we wish to promote for your later coursework and research, when you will be keeping your own lab notebook at a professional level. That is, the sorts of information that you are regularly *prompted* to enter in the spaces provided within these procedurals is, in a generic sense, the same sorts of information that you would enter in a professional lab notebook. You would do well to think of these procedurals as *pseudo-notebooks* for guiding and documenting your work.

Lab Summaries:
In typical lab work, an engineer or researcher will not only use a lab notebook to enhance their own planning, thinking, and analysis, ...they will also prepare regular reports for others (*e.g.*, a boss). So, in addition to maintaining your lab *pseudo-notebooks* during each lab meeting, you will be expected to spend no more than 30 minutes outside lab preparing very brief *lab summaries*.

Creating sharable, editable materials: Since much of your learning arises from *revision*, the materials we pass back and forth, electronically, ought to be easily *editable* (which excludes the .pdf format, which is designed for robust sharing without corruption of equations, *etc*., but is severely restricted in the kinds of editing that is easily allowed).

Software for Electronic Lab Notebooks:

Productivity-enhancing formatting tools made simple: What would you suggest for incorporating all the elements below, along with text formatted with clear **Section Headers** and **Bullet Points**, all cross-referenced to a **Table of Contents**? – For your lab notebook, we use Microsoft *OneNote*, in part because it is freely available to all IWU students, for use on their own devices. For this course, add a new notebook named "**PHYS106-S24-YourFirstNameLastInitial**."

As one student notes, "because we can type and insert images but also get the mobile app and draw additional images if need be." It is also easy to paste in certain kinds of simulations and, most importantly, to share your notebook (in editable form) with your instructor. You should check out the built-in HELP for a text-based tour, but documentation is poor for using *OneNote* to write equations, so we will be happy to simply *show* you how it works.

Sketches: A photo of your apparatus will typically be cluttered with extraneous elements. On the other hand, a simple sketch can efficiently guide the viewer towards key components. Have you ever tried using a touchscreen or tablet or phone to make quick sketches? As one student points out, *OneNote* allows that. A larger tablet with a stylus provides more natural control, but the key with any system will be to spend time practicing! It is also perfectly fine to use pen and paper to generate sketches, which you then photograph with your phone's camera, and import into *OneNote*.

Tables & Plots: *Igor Pro* allows you to generate publication-quality output via the Layout menu.

Each week, students download a "*lab procedural*" that introduces the lab of the week. You can, if you wish, directly import this into your *OneNote* lab notebook, and simply **annotate** it, wherever it prompts the sorts of "habits of entry" that that will help with carrying out the lab and analyzing the collected data.

Separate from those "*lab procedural*" packets, you are also expected to add a separate page, to serve as brief lab **summary report**, of the sort that you might give to your boss, if your lab work were being done for a company where you worked. The following is a guide as to what students should include in these *summary* reports. The goal is for these to be done quickly: it is important to develop habits that allow generation of lab reports in 30 minutes or so. NO ONE SHOULD BE SPENDING HOURS UPON HOURS DOING THESE. If you find that preparing your reports takes you longer than 30 minutes (or so), then you need to let your instructor and TAs know, so we can help you.

Each lab report can earn 20 points at most. If all the items below are included and done correctly, then the lab report should receive the full 20 points. Up to two of these points are granted for CORRECT work motivated by your own *initiative*. Initiative, of some (relatively straightforward) sort is required. Lab TAs must use some judgment here, but efforts earning over a single point will have to be reviewed by the instructor. Generally, the TAs follow this document and are asked to consult with the lab instructor or another grader if there are any questions: we would like to have as much consistency between lab graders as possible. We deduct a point for each item that is either missing or conveyed incorrectly. The amount deducted depends on the seriousness of the omission. **All** errors should be marked in red and serious errors (*e.g.*, missing analysis sections or other components) should have points deducted.

Note the following:

1. NO statement of purpose is required (it is given in the lab procedural)

2. NO introductory section is required (we do **not** need to see an *entire section* on the theory supplied in the procedure.)

3. Wherever students have done something special, they should include CONCISE procedural statements (things *not* necessarily included in the write-up. *e.g*. "We had to use the following non-standard procedure …")

4. On rare occasions, data tables but more commonly the data would be represented only through the most illuminating graph they have produced. (There should be no redundancy in the REPORT, *e.g.* do not include both a data table and graph of same data). If there is a need for a data table, it should be properly constructed (with clear headings and units). Graphs (if appropriate for the experiment) should have a title and the **axes are to be properly labeled**.

5. Results should be accurately and CONCISELY stated. (Note: "results" are often what falls out of analysis, *rather than* "raw" data.) Moreover, it is not enough to have a little table of fitting parameters on a graph and no explanation of the physical meaning of those parameters: we want an explicit description of the fitting functions (all parameters discussed with syntax connected to the theory *rather than* leaving them in the obscure notation used in *Excel* or *Igor Pro*).

8. Measurement uncertainty must be noted. It is important to at least "comment" on the accuracy and precision of the results, where possible noting how the magnitude of any difference between expectations and results compares with the magnitude of the uncertainty in the results. It is also important to try *identifying* the most significant source of uncertainty; a *concrete, specific* source is what we are looking for here (e.g., uncertainty in our measurement of the initial angle of the air track contributed the most to our uncertainty in the acceleration of the cart). It is not allowed to say that the source of uncertainty was "human error."

9. A meaningful conclusion based upon the analysis must be included.

NOTE: In general, the questions included in the materials that we give to the students (typically underlined in the manuals) are to be answered in the lab **report**. In addition, the lab report is chiefly intended to be a concise answer to the *following* question:

What did you do and what did you learn?

(The latter is often the result of some sort of ***analysis*** that you've done).