

LAB REPORT GUIDELINES

Welcome to Physics Labs here at the University of Tennessee. As your Teaching Assistant for labs, I want to help you understand physics. Why? Because, not only do I love physics, but I also love teaching it to others. Physics is, in some sense, the fundamental science that underlies everything about the natural world around us. If you need assistance, please ask for it.

Regarding the labs; they are wonderful from the standpoint of being able to provide accurate and reproducible experiments that demonstrate fundamental properties of physical laws. If you follow the instructions in the lab book precisely, you're almost assured of highly accurate results. However, sometimes the MEANING of what the experiments represent is lost on students, precisely BECAUSE the experiments, in an attempt to make the labs so precise, have become somewhat convoluted. This is why I usually take a few minutes to explain what the underlying physical principles are, as well as how they are being shown in a particular experiment. If I write comments on your paper, think about what those comments mean; if you're not sure, ask. I want you to be a better writer, and have a better understanding of the material.

Part the process of helping you understand what's going on is writing the lab reports. This is because one of the best ways to learn something is to have to explain it to someone else. Below are some guidelines for the process of writing up your lab reports. I discuss the labs report section by section – you should break your lab report up into the same sections I have used below. In general, lab reports should be typed (an optional exception is the calculations section), neat, and easy to read. There are many computer labs throughout campus where you can use computers and printers.

PURPOSE AND METHOD

This is the most important portion of the lab report, and consequently has the most points assigned to it. In this section you should show me that you understood what the purpose of the lab was, and what the underlying physical principles were. As a hint, the purpose of the lab experiment is usually to verify a particular law or relationship in physics, eg, that the acceleration due to gravity is 9.8 m/s^2 . The purpose of a lab report is almost NEVER the purpose stated in the lab manual.

On a related note, do not copy from the lab manual or any other sources. I consider this plagiarism, and if I am feeling benevolent, I will merely assign a grade of zero for the purpose and method section. If I am not feeling benevolent, or you've made a habit of copying from other sources, I'll make the entire grade zero. Using your own words is important, because it is the process of restructuring and rephrasing the material covered in the lectures and manual that helps you understand the material. If you need help understanding what was happening, feel free to email me, come by my office or lab, or get help in the tutoring center, but do NOT copy material wholesale.

The lab report, in addition to explaining the major goal of the experiment, should discuss any potential errors and how you accommodated for them. Most people find they can discuss these concepts adequately in 1 or at most 2 pages. Occasionally, someone will be able to convey the information succinctly enough to adequately demonstrate their understanding of the material in a few paragraphs, but this isn't common, and I recommend you take the approach of explaining the basic concepts and procedure as though you were explaining them to a friend.

This means that you should discuss WHAT the law in question was, WHAT you expected to see, and HOW you checked for that result. This does NOT mean that you should explain every nuance of the lab such as what information was typed into Excel. Remember you're trying to show me that you understand the physics, not that you know what numbers to enter.

If you don't know the meaning of a word or concept, look it up. There are numerous online references that can help you with definitions, concepts, and writing skills. Remember, success in any endeavor is partly based upon your ability to communicate your ideas to other people.

While I do not require you to include diagrams of your experimental setup, you are welcome to if you like. However, they should follow conventions where appropriate (especially for any sort of circuit diagram). They should also be (like the writing) your own work, not something you copied, photocopied, or scanned out of the lab manual.

DATA AND GRAPHS

This section is just the printout and/or photocopies of your lab data and results. This is supposed to be any easy 2 points, the only way you can get marked off here is if you didn't come to lab, or your printout is so difficult to read that I quit trying, or if your results were so far outside the acceptable error that the results don't even indicate the basic premise of the experiment. Do not ever submit original material; in the unlikely event that I lose your lab report, this provides proof that you actually did conduct the lab. All of the data, axis, etc. should be labeled clearly, with units as appropriate. A given set of data or graph should NOT hang over multiple pages. You may have to do some manipulating on the computer to get this to print out correctly. Any graphs should also have the data taking up most of the space on the graph; you may have to alter the default maximum and minimum scale values in order to do this.

CALCULATIONS

In this section, you should include EVERY formula you used in the process of analyzing your data. In addition, you should include one sample calculation, using YOUR data that you acquired during the experiment. The purpose of this is to make sure that you understand what the formulas were, and how they were applied (rather than just taking the results from Excel for granted). Additionally, if you have made a mistake entering your formulas in Excel, you may discover it when you calculate the answer by hand. This section is just 1 point. It should be quick and painless.

CONCLUSIONS

This is the second most important section of the lab report. Here you should restate the basic premise of the lab, and whether or not your results were in agreement with the theory. For most labs, I'll assign a "standard error" value, based on what I expect the standard deviation for the experiment to be (either by calculating the various experimental uncertainties or based on the error *I* got, whichever is greater). If your percent error is within the standard deviation, then your results agree with the theory within the bounds of the experimental uncertainty, and you merely need to recap the basic premise and your agreement with theory.

If your results do not agree within the standard error, but are within double the standard error, then you must include an error analysis section where you explain probable

sources for error. These should be SPECIFIC reasons, such as “friction between the cart and track” rather than general reasons such as “human error,” (which translates as “I did it wrong”). If you adequately explain your error, you still receive full credit for the experiment. Please note, however, that your sources of error must also make sense. If you calculate, based on your data, the value of “g” to be 10.0 m/s², then “air friction” is NOT a likely source of error, and you don’t get credit for the explanation.

In the event that your error is more than double the expected error, I’ll mark off 1 point from your “DATA” section, but I still expect to see an explanation. If your explanation is reasonable, you’ll still get full credit on the CONCLUSIONS section.

SAMPLE PURPOSE AND METHOD SECTION

This is a sample purpose and method section that I wrote to give you an idea of what I’m looking for, based on an experiment from the lab manual. Note that this is about as succinct as it is possible to make the PURPOSE AND METHOD section for full credit. If I had written anything less, I probably would have marked me off.

The purpose of this experiment was to verify Ohm’s law for resistors. Ohms law states that for a single resistor, the voltage is equal to the current times the resistance-
 $V=IR$

For resistors in series, the total resistance is the sum of the individual resistances,

$$R_t = \sum R_n$$

and for resistors in parallel, the total effective resistance is given by

$$(1/R_t) = \sum (1/R_n)$$

These relations were verified by both direct and indirect measurements. All measurements were made using a Simpson multimeter, capable of measuring resistance, potential, or current. Additional apparatus consisted of a variable DC power supply and a breadboard with a few resistors that could be set up in various modes (single, series, or parallel resistance) by wiring the breadboard to the power supply with various jumper leads.

Direct measurements were made by using the Simpson meter in the resistance mode and attaching the two probes of the meter to either end of the resistor configuration being measured. While making direct measurements, it is important that the circuit not be receiving a signal from the DC power supply, or else the power supply might be measured as part of the circuit by the Simpson meter.

Indirect measurements were made by measuring the potential across a resistor, or set of resistors, and then by measuring the current flowing through the appropriate resistors by inserting the Simpson meter in series with the resistor in question. By dividing the potential drop across a given resistor by the current flowing through it, the resistance could be determined.

These two methods, both direct and indirect, were conducted for each possible configuration- a single resistor, two resistors in series, and two resistors in parallel.

There you have it, feel free to contact me with any questions or concerns. Good luck and good learning.