

# 2DL Grading Guidelines

May 13, 2010

## Lab Notebooks

Your lab notebook is expected to have all of the physical data that you took during your experiment. You will be graded on both the completeness of your data and the labeling of this data.

### Completeness of Data

You need to write down the data exactly as you recorded it from the lab equipment. It is fine to make calculations in your lab notebook, but the original data needs to be present.

You need to record more than one trial of each measurement you take. All trials should be recorded in your lab notebook, even if you obtain the same result for both trials.

### Labeling of Data

Your data should be very clearly labeled. Someone who is familiar with the experiment but wasn't with you when you did the lab should be able to understand what data you took just by looking at your notebook. This means you need to identify what variables your measurements correspond to, the units of your data, and the experimental uncertainty in all of your measurements. Some data that you take may not correspond to a variable from the lab manual. In this case, you need to make up a variable for the data you took and describe this variable clearly with words or a picture (as necessary).

### Breakdown of Points for Lab Notebooks

The lab notebooks are scored out of four points. If you get less than a four, it is either because your data or labeling are not complete or clear. You will get an 'D' next to your score if your lab data was incomplete and an 'L' next to your score if the labeling was unclear or insufficient. The possible notebook scores are shown in table 1.

## Lab Reports

Your lab report should have a proper heading and four sections: Objective, Data, Analysis, and Conclusion.

Table 1: Lab Notebook Point Breakdown

4 points	
4	All required physical data taken and labeled clearly
3 points	
3L	All required data taken, but not labeled clearly
3D	Not all required data taken (i.e. not enough trials, not reporting physical measurements taken, experimental uncertainties missing), but data collected is labeled clearly
2 points	
2D	A significant amount of required data missing, but data collected is labeled clearly
2DL	Some data missing and data collected is not labeled clearly
1 point	
1	Significant amount of required data missing, and data collected is not labeled clearly

### Heading, Correct Sections, and Organization/Style (5 points)

Your heading must include the course name (Physics 2DL) and section (Tuesday, Wednesday, or Thursday), your name, the correct name and number of the experiment, and the date the experiment was performed.

### Objective (7 points)

Your objective should state the goal of your experiment, a clear description of the experiment and your procedure, an explanation of the basic physics of the experiment, and a clear diagram of the experiment.

### Data (13 points)

Your data section must include a table (or tables) of the required physical data you took, clearly labeled with units and uncertainties for all experimental quantities. If your data table uses variable names as headings instead of physical descriptions, you must the variables in this section. It is fine to include some of the analysis variables in your data table as long as all of the original measurements are shown clearly.

### Analysis (15 points)

This section should include all of the physics equations used in the calculations and a one or two sentence explanation of each equation. This should specifically say how the equation you are using applies to your experiment. This section will also contain your error analysis. Be sure to explain the error analysis you are doing, including the origin of your error analysis equations, and what quantities you are plugging in to each equation.

Your error analysis should be based on the ideas you have learned in this class. Namely, it is crucial that you estimate the uncertainties  $\delta x$  for each of your quantities  $x$ . Some quantities you will estimate based on your experimental apparatus and technique, and some you will have

to determine with error calculation. The goal of your analysis is to determine the range of error in your experimental apparatus/procedure. Then, in your conclusion, you must note whether the best known value for the quantity you are measuring falls within your range of error.

Lastly, all lab writeups except those for lab 2 (Michelson Interferometer) and lab 5 (Franck Hertz) should include a relevant plot. For labs one, three, four, and six, you should include a relevant plot whether or not you are instructed to make a plot in the lab manual. Make sure you explain why you are plotting the variables you chose and what you learn from your plot. All plots must have a title and labels on each axis (including units). Plots must also include error bars. The location of your error bars for each point is determined by your error calculations for that point. In other words, you should not use a default setting from your plotting program to determine the size of the error bars.

### **Conclusion (10 points)**

Your conclusion should first say whether your experimental results agree, within your experimental error, with the best known value of the quantity you are measuring. Whether or not they agree, you should explain all relevant sources of error in the experiment and procedure. Especially if your results did not agree with the best known value, evaluate the sources of error. This means you should estimate the uncertainty in your newly-thought-of sources of error. Then show (with calculations) whether this would explain the outcome of your measurements.