Elements of a Formal Lab Report

A lab report should be a well-written model of scientific integrity and should include several elements:

(1) **Title, Author(s) and Abstract**
The goal of an abstract is to set down clearly and *concisely* what experiment was performed and the basic results obtained. The goal of an abstract is to provide the reader with a quick summary of what you did so that they can tell whether the rest of your report is relevant to the research they are doing. If the point of the experiment was to measure a particular physical quantity, then a good abstract will mention the measured value of that quantity with its associated uncertainty, along with a comparison to a theoretical or expected value.

(2) **Introduction**
The introduction should introduce the basic ideas behind the lab, and explain them clearly and concisely. What's the point of the experiment? This is the section where you introduce the theoretical background to the experiment and discuss what your hypothesis is and what you predict as an outcome. How will you test your hypothesis and what will determine success or failure of you your hypothesis?

(3) **Procedure**
The procedure section should include a detailed *narrative* description of how you conducted the experiment. That is, I do not want to see a numerical list of steps, and I do not want you to write the procedure section as a set of instructions to another student—just describe clearly and specifically what **you** did. Feel free to use the pronouns *I* (if you worked alone) or *we* (if you worked in a group). In the course of this description, the materials used in the experiment should naturally be mentioned and you should make sure to include sketches (or photos; but be careful—sometimes schematic diagrams are far more clear than a photograph) of the experimental setup. The reader should be able to reconstruct your experiment from your description.

(4) **Data and Analysis**
The data you recorded for the experiment should be presented in a neat fashion, *preferably in tabular form.* The important point is that the data should be understandable. Make sure you include units and uncertainties for each measured quantity! Also, record the conditions under which the measurement was made where appropriate. Show one sample calculation for each unique type of calculation needed to complete your data table. At the end of the lab report, please attach the actual raw data (no matter how messy!). Generally speaking, your analysis of the experiment will involve a discussion of the data, and this discussion will likely include one or several graphs together with your interpretation of the information contained with each graph.

(5) **Conclusions**
What conclusion do you draw from your experiment? What have you learned? What

(if any) problems remain unanswered as a result of your work? If the point of the lab was to measure one or more quantities, you should give your final (best) values for these quantities along with their uncertainties.

Other Suggestions

- Write your lab report so that you would be able to look at it five years from now and understand what you did. Consider your audience to be students at another university taking a similar course.
- Be concise. Write well and use proper English! Vary the style of each sentence so that the report flows. Avoid writing a series of short sentences or long ones for that matter! Variety! A good rule of thumb is to read your lab aloud to yourself (or a friend) to hear whether it flows and whether what you wrote makes sense.
- Take measurements as accurately as the equipment allows.
- Try to develop the habit of asking questions, doing measurements or calculations that allow you to check whether your data is understandable. **Be skeptical!**
- Make sure your graphs are clearly labeled! This includes axes labels (with units) and a descriptive title. A good graph will also show any appropriate fits and will label important features of the graph. Don't forget to use error bars where appropriate. When you draw a graph, there is typically some information that can be gleaned from it! Never draw a graph that goes uncommented in the text of the lab report.
- An outstanding lab will pose "what if questions" and gather, analyze and interpret data in attempt to answer the questions. Such reports go beyond the original scope of the lab.

Example of a Title Page with an Abstract

Determination of g via free fall

Joe Q. Student
University of Southern Maine
6 June 2026

*W*e determined the acceleration due to gravity by using a Pasco Scientific free fall apparatus. A steel ball bearing was dropped repeatedly from different heights and the fall times were recorded to the the nearest 0.001 second. We used the fall heights and times to graphically determine g to be 9.79 $\pm$0.09 m/s^2. This is consistent with the known value of g at our location in Portland, ME.

Checklist

1. Name(s) on report; indicate who wrote what sections.
2. Uncertainties on ALL measured quantities.
3. Neat data tables with units and uncertainties.
4. Axes labels and units on plots.
5. If you made a plot, you should show error bars (they may be small) and your best fit curve—in this class, it's likely to be a line.
6. Make sure to show the high and low slope lines and the uncertainty in the slope for any straight line fits. Do you have units for your slope?
7. **Nowhere** should you ever use "*human error*" as the sole explanation of why something didn't come out right. Human error with regard measurement of some quantity, for example can induce random error or systematic error—but if this is the case, random error should show up in uncertainty calculations and you should quantitatively estimate the effect of any systematic errors. If you are using *Human Error* as an explanation in some generic unspecified way, that is a non-explanation with no merit. You will very likely lose points if you use this in your conclusion.