Laboratory Reports

You will need to keep careful and complete records of all observations and measurements done in the laboratory. Then you will need to write a report for most laboratories in this course. I will have to grade these reports. Since writing reports is probably not your idea of a good time, and grading is definitely not my favorite pastime, I want to try and ease both our tasks. Hence this document.

Laboratory Reports

The report serves two main purposes – it provides you with an opportunity to hone your skills in written communication of your experimental findings; it provides me with an opportunity to assess your biology abilities and knowledge as well as your communication skills.

The best reports are

- **Concise** – I will be grading over 60 lab reports every week for the next few months. Most reports need not be longer than 3 pages, at the very most
- **Clear** – I am not a detective, so make sure your writing is accurate and unambiguous
- **Well-organized** – spend about 10 minutes planning your report before you start writing
- **Easily legible** – if you type it, great. If your report is handwritten, make sure it is in ink and make sure your writing is easy to decipher
- **Complete** – answer all questions and do all calculations requested

The lab report should be written on standard 8½”×11” paper, and must have a single staple through the top left hand corner. Begin each report with a header as follows:

<table>
<thead>
<tr>
<th>Name 1 (yours)</th>
<th>Class</th>
<th>Date of lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name 2 (names of any lab partners)</td>
<td></td>
<td>Lab Section</td>
</tr>
</tbody>
</table>

**Lab Number and Title**

The body of the lab report should be written in a reasonably scientific style. This tends to be somewhat impersonal and passive. For example, it is better to write “the density was determined to be 3.25 g/ml”, rather than “I/we calculated the density to be 3.25 g/ml”.

The lab report should have the following sections:

Objective
In a sentence or short paragraph, what was the purpose of the lab? There is usually a purpose at the top of each lab, but don't just copy the purpose. Read, digest, understand and restate the purpose in your own words.

Hypothesis
Write out your hypothesis for the experiment (include separate hypotheses for different parts of the experiment where applicable).

Experimental Procedure
What steps did you actually carry out in the lab? This is somewhat like a recipe in a recipe book. Since the lab manual gives the detailed procedure, there is no need for you to repeat it here. Normally, you need only write “Refer to lab manual”. The only exceptions will be where the procedure was different from that in the manual, in which case you should write out the changed parts of the procedure.

Results
Here is where you communicate your observations, measurements and calculations in a clear, concise, scientifically acceptable fashion. Indicate your control group(s) and their significance. Usually, if a lot of similar measurements or calculations were made, they are best presented in tables. All critical data should be in your report – for example, all accurately measured masses, temperatures, color readings, times, etc. Graphs are another useful way of presenting certain types of data. (Tables and graphs are described in more detail on the next page.) Even where you don’t use tables or graphs, avoid a narrative presentation. Rather, summarize your important results and answers, e.g.:

Concentration of acid = 0.0235 g/ml
Concentration of base = 0.0518 g/ml

Where calculations are involved, show one complete sample of each different type of calculation done.

Discussion
What conclusions can you draw from this experiment? This is also a good place to answer any specific questions, asked in the manual, that were not addressed under “Results”. You might also want to try to make an assessment of the lab:

- Was the objective achieved? Are the results reliable? If not, why not? How do your answers compare with what you might have expected?
- How could the experiment be improved? What did you get out of the lab?
- Finally, this is your chance to go the “extra mile” – show the extra initiative that earns you 20/20 instead of 19/20!
Tables and Graphs

Tables and graphs have much in common:
- They present data visually in a clear, organized, compact fashion
- The reader should be able to understand them as they stand, without outside help
- They should be numbered: e.g. Table 1; Figure 2 (for a graph), etc
- They should have a short, informative caption or title, immediately following the number. For example: “Table 1. Titration of beverage samples” “Figure 2. Water level versus time for corrosion of steel wool in air”
- They should be referred to, by number, in the text. This would most often be done in the Results or Discussion sections of your report

Specific Features of Tables
- Always look for ways to present data in tables (especially numerical data) rather than in narrative style
- Three horizontal lines create a neat “frame” for a table.
- Where units are appropriate, they should be in the column header, not in the data column itself, and definitely not absent!).
- There shouldn’t be redundant data in any column of a table, such as a repeating, constant, value. Constant values can be given as footnotes, or perhaps in the title

Specific Features of Graphs
- By convention, we say that the y-quantity (vertical axis) is plotted against the x-quantity (horizontal axis), not the other way around!
- Graphs may be drawn by hand or, preferably, by computer (e.g. Excel) provided that they show an appropriate level of detail. If you use Excel for scientific graphs, the default type (“column”) is not always appropriate. It is often correct to select “XY (scatter)” as the chart type.
- For accurate work, hand-drawn graphs should be on graph paper, in ink
- Each axis is labeled with the quantity being plotted and its units (e.g., “volume, mL”, or “volume (mL)”)
- Each axis generally has a linear scale. Major scale divisions are marked by ticks, and numbered, e.g. 0, 10, 20, etc
- The scale should be chosen carefully so that most of the available plotting area is utilized
- The scale should be easy to use: 1 grid division should be equal to 1 or 2 or 5 of the scale units, or some 10^(n) multiple or submultiple thereof. Don’t try 1:3, 1:4, 1:6 ratios, etc, and don’t change the scale as you go along the axis!
- Plot points boldly so that they don’t risk being lost (e.g. use ° or •, not ·)
- Don’t just automatically “join the dots”. Sometimes this is appropriate, but often, the best line doesn’t go through any of the individual points. If this is the case, draw the best smooth trend line through the points. If the best trend line is a straight line, use a ruler to draw it!
Good Graph vs. Bad Graph

A. Figure 1. Average Chem100 quiz scores versus time spent studying

B. Time studying versus average Chem100 quiz scores