

## FORMAL LAB REPORTS – McClung

The following are guidelines for what should be contained in each section of a formal lab report. It is very important that your reports are detailed and thorough. **Lab reports must be word processed. Raw data must be written in blue or black ink.** Graphs may be plotted in pencil but the axes should be labeled in ink. You should never write in first person in any section of your report. Always try to use specific, formal and scientific language.

Handout: If there is a lab handout, it should be stapled on the front of your lab report.

Heading: At the top of the page, put the title of the experiment, your name, the date the experiment was performed and the name of your lab partner.

### Research Question/Objective

In one or two sentences (or in question format, if you prefer), explain the reason (purpose) for performing the lab. When applicable, include the balanced chemical equation for the reaction being studied.

### Variables

This section should only be included if you are doing a "planning" experiment. (ie. an experiment where you develop your own procedures) In this section, you should **list the independent variable(s) and the dependent variable(s)** and then make a **table of the controlled variables** as follows:

The independent variable in this experiment is \_\_\_\_\_.

The dependent variable in this experiment is \_\_\_\_\_.

**Table 1: Controlled Variables**

Controlled Variable	How the Variable is Likely to Affect the Outcome of the Experiment	How the Variable Will be Controlled

**You must list all necessary controlled variables. There is not a correct number to list; you need to include everything that will be required to carry out a good experiment.**

### Hypothesis

Your hypothesis should be an educated guess about the outcome of the experiment. Be sure your hypothesis can be tested by the experiment you are doing. You must also explain why you think this. Be sure to cite your source if you use one here.

### Materials

In this section you should list all the equipment, chemicals and other materials that are used in the experiment.

### Procedure

Many times this will be given to you but if you are developing your own experiment, then you will need to write this section. It should be written in "recipe format," that is, a numbered list of steps to follow. The materials and methods should be described in sufficient detail to enable someone to repeat your experiment without having to consult any other written materials. This means telling exactly how to perform each trial that you actually did. (Ex. Measure out 5.0 g of sodium carbonate...NOT: Measure out a chosen mass of sodium carbonate.) Note here that it is critical to describe things such as reaction conditions (e.g. temperature, length of time reaction was run, solution composition and concentration), but that it is unnecessary to describe trivial information such as test tube size. You may assume the reader knows how to properly use any equipment but does not know what settings were used. For instance, you do not need to describe in detail how to work a hot plate but you will need to state at what level the instrument was set. If the procedures for an experiment were taken directly from a lab handout, you may simply write "See Lab Handout" but you must note any changes. If the procedure is not provided, write it as you do the lab. Don't wait until a week has gone by...you will have forgotten too much info.

### Data and Calculations:

This section should be a presentation of data you have collected in your experiment. Include all observations and measurements you have made.

**Qualitative data** should be written in complete sentences describing what you observed during the course of the experiment. **Quantitative data** and mathematical calculations should be in the form of tables and/or graphs. Each table should be labeled with a title and number (e.g. Table 1: The Effect of Concentration of Reactants on Reaction Rate) and **all data must be written in ink**. Sometimes it is appropriate to have stand alone data, a measurement that is taken once during the lab and doesn't really fit in a table. (For example, the room temperature for the entire experiment may be required. This would be recorded as stand-alone data.) The results of mathematical calculations should be included in a table as well. An example of each calculation should be shown below the table. Furthermore, you must remember to use unit labels for the data and round your answers according to significant figure rules. **You must not recopy raw data collected in the lab. Your data tables must be constructed ahead of time and be initialed by me prior to conducting the experiment. This raw data must be included as an appendix to your lab report and then you should re-type it in the body of your report.**

Your calculations section should always include a graph unless the lab handout says otherwise. It may be computer generated or made by hand but it must follow all the rules of graphing as given at the beginning of this course.

Your lab handout will usually give guidance about what calculations should be included.

#### Conclusion and Evaluation:

This section of your lab report should be quite extensive and should be written in complete sentences. DO NOT repeat your procedures here; it is meant to be a critical evaluation of your results.

First of all, you should draw conclusions about your data. Explain why you are drawing these conclusions and tell whether your hypothesis was supported or not supported by the data (NEVER use the word "prove" here).

Secondly, you should discuss sources of error in the experiment (at least 3) and EXPLAIN the effect of each error; don't just make a list. Note that there are 3 types of errors: 1) systematic (e.g. loss of product during filtration), 2) random (e.g. a sudden change in temperature conditions), and 3) incompetence of the experimenter (e.g. undue haste, klutz in the lab, didn't know how to read the equipment, etc.). In a lab report, one discusses the first two kinds of error, **but not the third!**

After identifying the error, explain the effect of the error on the results. (e.g. Some heat was lost to the atmosphere so the temperature change that was measured was not as large as it should have been. This made the final results lower than the true value.)

Thirdly, you should discuss how the experiment could be improved. You must suggest an improvement to minimize every error identified. Do not critique the way the procedures are written in the handout. Also, do not discuss other experiments that might be interesting. Describe how you could do the investigation again with improvements.

**You must describe all the possible sources of error. There is not a magic number of errors that should be described in every experiment.**

#### References:

This section should cite all references (if any at all) used in the performance of the experiment and in the writing of the report. You do not need to cite the lab handout.

#### Personal Statement:

Add the following statement to the end of your lab report:

I certify that the work shown in this report is my own, unaided work. I have not plagiarized from other students or reference materials. YOUR SIGNATURE

**REMINDER:** You may consult with others (classmates and/or teachers) during lab and before writing your lab report. You must write up the lab report on your own. You may not copy or paraphrase (reword) someone else's work. That is considered plagiarism. There should be no section in your lab report that is identical to your lab partner's except the values of your raw data. **Never e-mail any section of your lab report to another person. If someone else copies your work, you can also suffer the consequences.**