Keeping Your Laboratory Notes

As in any writing, you should strive for content, organization, and clarity. You should know ahead of time what each step of a procedure is trying to accomplish. As a scientist, you will either be trying something new and making up your procedure yourself, or you will be trying to repeat something from the literature, perhaps in a better way or for a different purpose. Either way, you must have some idea what a particular step or procedure is for *before* you do it. If you can't figure something out, *ask*!

The following organization for your lab work, even for small laboratory exercises, will help you focus on what is important and find things when you need them later. **Grading will be based on your use of this style**.

PURPOSE. State the object of your experiment in *one sentence.* Be specific so that you will know when you have accomplished your objective. For example, "Determine the molarity of a NaOH solution" is more useful than "Learn more about acids and bases." Write down the purpose *before* you start any lab work.

METHOD. *How* will you go about achieving that stated purpose? Briefly outline the principles involved in the experimental procedure you plan to use. Including numbers is usually too much detail. You should try to summarize as briefly as possible the *logic* of what you plan to do. Method is *not* a list of the steps in the procedure. The method for a synthesis might be the chemical equation for the reaction you plan to carry out, or for an analysis the method might be "I will determine the moles of acid by titrating with standard base using phenolphthalein as the indicator." Write down the method *before* you start any lab work.

ACTIONS AND OBSERVATIONS. Record what you *do* and what you *see* in your own words and sketches. Most procedural errors involve misunderstanding, and we can often figure out what went wrong if your notes contain what you actually did and saw**. Your laboratory notes should be written so that someone with a background comparable to yours could repeat the experiment based solely on what you have recorded**. *Copy down information from the labels of the reagent bottles as you use them.* (Is the bottle labeled 1.78 g $AgNO_3$/liter really the 0.1 mole/liter solution you were supposed to use?) Include all amounts (with units) and how you measured them. You need to be able to tell from your notes the date on which you actually did the work and with whom you worked. Observe what happens and write it down while you are writing down your actions, not later as a separate section. Write this section *during* the experiment, *as you record each step of your actions*. Simple sentences, sequences of notes, outlines and sketches, or a table with one column for actions and a second column for observations are easier to follow than a dense paragraph of continuous prose.

DATA. *Record all data directly in your lab notes and label all entries* – what you have measured and in what units. *Use tabular form* for data as much as possible. For analytical balance or buret readings, record initial and final readings, not just the subtracted result. This data section must be written *during* the experiment.

CALCULATIONS AND GRAPHS. Provide an example or explain *how the data you obtained in lab are used to obtain the final result you report*. Calculations without labels and units are not sufficient even if they come out correctly. (Remember, you may need to be able to reconstruct what you did months later.) If the report requires repetitive calculations for more than one set of data, show the calculations for one set and tabulate the rest. *Show <u>units</u> on all numbers*. Make sure that units cancel properly in calculations. *Graphs should have a title and have labeled axes.*

DISCUSSION. *Answer the question posed by the PURPOSE; discuss and summarize any numerical results*. Your discussion should be written in paragraph form and tie together what you are learning in the classroom and lab. Always include some estimate of the uncertainty in any numerical result. In general chemistry this often means reporting your results to the proper number of significant digits and *identifying which measurement limited the number of significant figures* (see Section 1.5 in your textbook). If you can identify any specific sources of bias in your measurements or assumptions in your method that would affect your result, indicate whether each will tend to make your results high or whether they will tend to make your results low. A general reference to "human error" is not useful. *Answer the questions posed in laboratory directions.* Understanding, explaining, and knowing the limitations of what you have done are as important as getting the "correct" answer (assuming a "correct" answer or result exists).