The laboratory notebook provides a written record of what you have done and observed. It should be complete and correct enough so that someone who is not familiar with your work could reproduce your work by following your notes. They should know what to do and should know what they will observe while they perform the experiment.

**Introduction:**
One of the most useful skills you will acquire in the laboratory is the proper use of a laboratory notebook. Notebooks are an essential tool in many careers, ranging from that of the research scientist to that of the practicing physician. The effort invested in developing good habits of notebook use will be amply repaid for students who pursue a future in the basic or applied sciences. Experience has indicated that skillful notebook use is developed by most students only through continued special effort – it does not come naturally! The laboratory notebook is perhaps the single most important piece of laboratory equipment. The laboratory notebook is a complete record of what you have done in the lab. In a “real life” research situation, someone may have to reproduce your work several years after you have left the laboratory and the only record they will have to rely on will be what you wrote in your notebook. In both academic and industrial settings, the notebook is a legal document that records your original work.

**Standard Notebook Sections:**

**Header:** The experiment title, date, student name, and laboratory information must be filled out for every page of the notebook. You should also identify your partner(s) by first and last name if you are not working alone.

**Purpose:** It is essential that this section be completed prior to the beginning of the laboratory period. The purpose section of the notebook is a brief explanation of what you are planning to do and why you are doing it. For example, “a titration will be done to determine the concentration of acetic acid in vinegar”.

**Procedure:** Prior to the laboratory experiment, a brief outline of the procedure should be entered into the notebook for use as a guide to the experiment. This should NOT be the word-for-word procedure from the lab handout. It should be a shorter version of the procedure that indicates what the key steps are. During the laboratory experiment, the exact steps of the experiment must be recorded so that the experiment can be repeated by another person. Often the recording of the procedure takes longer than performing the experiment!

**Data:** Your observations are data. Everything that you see and hear which may impact the experiment needs to be recorded. For each substance, the clarity, color and state of matter are the minimum observations to be recorded (e.g. the sample is a clear, colorless liquid). Any changes that occur, such as the release of bubbles, a fluctuation in the reading of an instrument or a color change should be recorded as soon as they are observed.
Often you will record large amounts of numerical data during an experiment. It is normal for a scientist to create data tables for the recording of this data and to have them ready prior to experimentation. In order to help you to keep an organized notebook, we will often give you the format for the data tables that you will include in your notebook. It is important that all students use the same format for their data tables!!

**Your experiments will go much more quickly and be much more enjoyable if you create the data tables in your notebook prior to coming to the laboratory.** The data tables are often placed in appropriate places within the procedure section. For instance, a table for the masses of 12 pennies might immediately follow the procedural statement “12 pennies were weighed”.

**Calculations:** In real life, the person who needs to follow your work is not a chemistry instructor, and often will be someone who does not know chemistry well. Thus, it is very important to **show each calculation clearly and completely for the reader**. Include units with each number and round final reported answers to the proper number of significant figures. In some cases, your instructor will give you permission to provide only an example calculation for each trial, but in the absence of such an instruction, **every calculation that you perform should be recorded properly.**

**Showing Calculations**

ALL calculations must be shown in your lab notebook during the semester. To receive full credit for your calculations, the following should always be followed

- Write down any formulas that you use in your calculations.
- Each step in the calculation should be shown clearly.
- Report the result of the calculation with units (unrounded)
- Report the final answer, with units, to the correct number of significant figures.

**Example:**

\[
A = l \times w \\
A = 2.34 \text{ cm} \times 1.2 \text{ cm} \\
A = 2.808 \text{ cm}^2 \\
A = 2.8 \text{ cm}^2
\]

**Discussion:** Often times the observations or the results of calculations require some analysis or explanation. A discussion of the results of an experiment often follows the data and calculations section so that the reader knows the significance of the results. If comparisons to other work or the expected results are done, these comparisons are discussed here. Interpretations of data like “the clear colorless liquid isolated in the distillation is water” are discussed to explain why the conclusion was made.

**Conclusions:** The conclusion section directly corresponds to the purpose section. If the purpose of an experiment was to determine a concentration, the conclusion will be something like “the concentration of the acetic acid solution was determined to be 0.124 M”. If an experiment or set of experiments had three purposes, the result of each part of the study should be reported. In addition, sometimes interesting conclusions are made that were not expected. “The new methyl fulminate compound is surprisingly explosive” may have been a conclusion statement in a scientist’s notebook.
**Rules of thumb:**

- Always record entries legibly, neatly, and in permanent ink. Pencil is never used!
- Immediately enter into your notebook and date all original concepts, data, and observations, using separate heading to differentiate each.
- Record all concepts, results, references, and other information in a systematic and orderly manner.
- It is acceptable to make your entries brief. However, you should always include enough details for someone else (or you) to successfully duplicate the work you have recorded.
- **Label all tables, figures, and calculations.** It is very unlikely that you will remember each step or calculation once you leave lab.
- **Never** remove the original pages from your notebook. The carbon copies of data tables and calculations will be turned in with your lab reports.

**Guidelines:**

- Start entries at the top of the first page. Do not skip pages. Title the first page with the first experiment. All pages used for that experiment can be title the same or you may write “Continued” for the title.
- Date each page before you leave lab. Sign the bottom of each page before you leave lab.
- Never let anyone other than yourself write in your notebook. The only exception to this is a witness’ signature or your instructor’s initials or signatures for grading purposes.
- Never leave blank spaces, and never erase or remove material you have added. Simply draw lines through blank spaces at the same time you are making your entries.
- Do not erase errors. Erasing errors should be impossible, since ALL entries should be written in pen with permanent ink! Just draw a single line through any erroneous entry, and then add your initials. Enter the correct entry near to the incorrect attempt. When you are using a duplicate page notebook, erasures leave markings on the page below.