# THE LABORATORY NOTEBOOK

## INTRODUCTION

Chemistry is an experimental science. As such, much of the progress of chemistry depends on the communication of scientific data and experimental results between researchers. It is important, therefore, that a course in chemistry should teach how to accurately record scientific data and experimental results through the use of the laboratory notebook and laboratory reports.

## THE LABORATORY NOTEBOOK

The laboratory notebook is meant to be a permanent record of the experimental data and observations that one measures or observes during experiments. During the laboratory period all data and observations are to be recorded **DIRECTLY** into the laboratory notebook and **NOT** on separate sheets of paper nor the data pages of the experiment or laboratory manual. (These data pages may be used in your laboratory reports.)

The laboratory notebook is meant to be used as a **WORKBOOK**, it is functional, not pretty. It will contain both satisfactory and unsatisfactory results, errors and corrections, calculations, graphs, and other information from the laboratory experiments. Since all entries are made in the laboratory, it is expected that the information be orderly, legible, and clearly labeled, sufficient so that the information is comprehensible to someone with training comparable to your own. The notebook will not be graded on its appearance, it will be graded mainly on its content.

The laboratory notebook must be a **BOUND** book with sewn-in pages and a cover, such as a "Composition Book" or equivalent. Spiral, loose-leaf, and perfect binding (pasted-in pages) notebooks are **NOT ACCEPTABLE**. Quadrille pages are preferred, but lined pages are acceptable. The guidelines for keeping the laboratory notebook are listed below: (NOTE: Your laboratory instructor may request that the information you record in your laboratory notebook differs from this format to fit the requirements for your particular laboratory course.)

### RULES FOR KEEPING THE LABORATORY NOTEBOOK

1. All entries must be made in **INK**.

2. All pages in the notebook must be numbered consecutively, beginning with the first page.

3. The first two sheets (pages 1 through 4) reserved for a **TABLE OF CONTENTS**, which must be kept up to date with the number of the experiment (number them consecutively), the title of the experiment, and the notebook page on which it begins.

4. When recording information in the notebook, write on the **RIGHT-HAND PAGES** only (unless a double page is needed for a large table or graph). Generally, the left-hand pages are used for notes or calculations for the experiment.

5. Under no circumstances should an erroneous entry be erased or obliterated. If an error is made, either draw a single horizontal line through it or a single X through it, **leaving the error readable** (you may later decide that the erroneous value was usable). The correct data should be recorded nearby.

6. Under no circumstances should any pages be removed from the notebook. If a page of data or notes is wrong, draw one large X through the page with a short notation explaining the reason for striking out the page. Continue with your notes on the next available page.

7. Start each new experiment on a new page. If you do not complete an experiment or miss an experiment, do not leave blank pages for the missing material. If you complete the experiment at a later date, the data should be entered on the next available page **in date order**. (Do not forget to note the page number in the table of contents.)

8. All data must be entered **directly into the laboratory notebook**. Never record data on loose pieces of paper for later transcription into the notebook.

9. As you complete each page in the notebook, sign and date the page at the bottom. Void all remaining blank spaces with either an X or a single diagonal line.

10. The following information should be recorded in the laboratory notebook for each experiment:

    a) The **title** of the experiment.

    b) The **date** the experiment is performed.

    c) The name of any **partner** who worked with you. If you work alone, omit this part.

    d) A sentence stating the **object** or purpose of the experiment.

    e) A **reference** to the source of the procedure for the experiment, if known. List the author's name, title of the book (underlined), edition number (if second edition or later), publisher's name, location of publisher (city), most recent date of copyright of book, and page numbers of the experiment.

    f) Any **safety precautions** that must be observed in the handling and use of any of the chemical reagents in the experiment along with any safety modifications of apparatus or experiment set-ups.

    g) Any **disposal** information that must be observed for the chemical reagents and products of the experiment.

    h) Any **changes** in the experimental procedure or other pertinent information from the pre-lab lecture.

    i) A *brief* account of the **PROCEDURE YOU ACTUALLY FOLLOWED** including **ALL THE EXPERIMENTAL DATA** as you record it. Include observations such as colors or color changes, formation of precipitates, odors of materials, textures or forms of compounds, visible physical changes, etc. For numerical data, label each item clearly, include all significant figures and the proper units. Be sure to include the number of any unknown sample used in the experiment. Do **not** copy the data pages in the experiment or laboratory manual directly into the notebook. The data pages can be used as a guide as to which numerical values are important, however, in many instances, there is more information needed for an experiment than what is asked for on the data page of the experiment. Remember, the information you record can give valuable clues in determining your final results or in determining what went wrong.

    j) **Calculation** of the final results. Show the complete set-up, including the formulas used, the numerical data, and the final answer. Observe the proper number of significant figures and be sure to include the proper units. A sample calculation is shown below:

Example: The density of unknown metal no. 25 (title)

$$Density = \frac{mass}{volume}$$ (Step 1: The formula)

$$= \frac{25.458g}{3.85mL}$$ (Step 2: Substitution of data)

*Density* = 6.61 g/mL (Step 3: The answer)

The calculations of the results can be written on the left-hand pages of the notebook, opposite the data. (The calculations can be completed at home.)

k) **Graphs** (when required) can be constructed directly in the laboratory notebook if it is quadrille ruled, otherwise, the graph should be drawn on graph paper and fastened into the notebook (paste or glue is preferred over tape or staples). The graph should be titled with all axes clearly labeled. (Graphs can be constructed at home.)

l) General **results and conclusions**. This is a *brief* discussion or summary of the results of the experiment with regard to such questions as "do the results of the experiment appear to be reasonable?", "do the values obtained agree with published results (if known or available)?", "did I prove the principle that the experiment was demonstrating?", or "was the purpose of the experiment accomplished?". Keep this discussion brief and in general terms in the notebook as its main purpose is to help you review the experiment and results before writing a more polished and detailed version for the laboratory report. (This discussion can be written at home.)

m) A brief discussion of **errors** (when required). See "Error Analysis in Chemistry Experiments" following the section on "Laboratory Reports". (This section can be completed at home.)

11. For QUALITATIVE ANALYSIS EXPERIMENTS, the notebook should contain:

a) The analytical group number and name.

b) A reference to the source of the procedure.

c) The **safety precautions** and **disposal** information for any hazardous materials used in the analytical procedure

d) A flow diagram of the group analysis which is corrected to show any changes in the analytical scheme.

e) The date of the analysis. (If the analysis is performed over more than one lab period, date each section of the analysis.)

f) A running account of the analysis of the KNOWN sample AS YOU PERFORMED IT. Include the name or formula of the reagent added, the observed result (if any) including any color changes, and a few words telling what the result may indicate or what precipitate(s) may be present.

g) A running account of the UNKNOWN sample analysis. This should follow the same format as the analysis of the known sample. Be sure to include the number of the unknown sample in your notebook.

h) A listing of the ions found present in the unknown sample.

12. At the end of each laboratory period, you must present your notebook to your laboratory instructor, who will initial or sign the pages of notes recorded during that lab period. Your instructor will also offer suggestions for improving future record-keeping.

Notebooks can be spot checked at any time and they are expected to be up to date. Should there be any major errors or omissions in your experimental results, as reported in your laboratory report, you will be asked to produce your lab notebook. Credit will NOT be given if the notebook is not up to date containing the proper information.