

Preparing and Maintaining the Laboratory Notebook

The act of writing requires the scientist to stop and think about that is going on. The purpose of keeping a lab notebook is thus to provide a thorough and permanent record of all mental and physical activities from a scientist's work. It ideally includes everything from preliminary research to conclusions that result in the ultimate understanding of phenomena.

The notebook preserves experimental data and observations in unalterable form. It is always a bound volume with numbered pages, so pages cannot be inserted or removed. It is admissible evidence in a court of law.

Students keep notebooks because it is a course requirement and a learning process. Good notekeeping is a discipline that takes time and effort to learn, but is a valuable asset in many careers. Advanced students will need a record of their work when writing research papers, theses, or dissertations. Industrial scientists keep records to protect themselves in court and to document discoveries that may lead to patents and much money. Businesses and manufacturers keep logs of analyses of their products and production. All must be neat, accurate, and unalterable.

Writing the Laboratory Notebook

In keeping a lab notebook, the idea of "right-hand pages" and "left-hand pages" is important. If you start with the front of the first page as page 1, the right hand pages will all have odd numbers and the left-hand pages will all have even numbers. Number all pages in the upper outside corner before you begin to use the notebook. As you work, you will record the day's date below the page number on each page. Right-hand pages contain preparatory work such as intro, materials, and procedures. Left-hand pages hold chemical information, data tables, equations, calculations tables. Do the Chemical Information (left page) then the Abstract, Introduction, Source and Safety, and Materials (all right page) first. Then plan the layout of your Procedure and Data Table so that you can read from the right-hand page as you record data on the left-hand page. Don't leave blank pages.

When you are beginning calculations, data analysis, or conclusion, you may write on either page so as to use your space well and leave no blank pages.

The Title Page is Page 1. It includes the following information, centered on the page:

Laboratory Notebook for (name of class)
(your name)
Memorial High School
St. Marys, Ohio
Began _____ Ended _____
Class period _____
Station Number _____

Page 2 is left blank, except for the page #. It is the back of page 1.

Page 3 is the Table of Contents. Set it up as follows, on the next page:

Chemistry is a laboratory course. Complete laboratory notebooks are a requirement for course credit.

*****sample page*****sample page*****sample page*****sample page*****

Table of Contents

<u>Date</u>	<u>Experiment Title</u>	<u>Page Number</u>	<u>Grade</u>
9/7/96	Matter and Energy	6-15	70/75
9/10/01	Physical and Chemical Change	16-21	35/38

Pages 4 and 5 are left blank to use as Table of Contents.

Begin your first experimental write-up on pages 6-7.

General Guidelines:

- lab books are written only by the owner and are prepared before lab or are written during lab, while performing the work
- author must sign and date the entry
- each section has a clear, descriptive heading (Hypothesis, Data, Safety, Data Tables. Etc.)
- handwriting is legible and correct grammar is used
- active voice in first person to tell what was done and who did it. Third person is reserved for the formal laboratory report.
- Use indelible ink only, non-erasable. If you're not sure about your pen, write on a piece of paper and hold the paper under running water. If you can still read it when you turn off the water, the ink is fine. You don't want to lose an hour's work because of a spill on your lab book.
- Errors are handled by drawing ONE line through the incorrect information. The correct information is written near the crossed-out info when possible, If this is not possible, re-write the table elsewhere in the lab book. Write "see pg XX" near the errors to direct the reader to the correct information. White-out or scribbling are NEVER used in a laboratory notebook.

Notebook writeups will include the following unless noted otherwise on the individual handout. Be sure to read the handout, and listen in class for specific instructions.

Upper right corner of the first page of each lab will have your name, the date the lab was done, and co: Partner Name.

Chemical Information: (left)

In table format, first entry on top of left hand page, first page of lab. It must be completed PRIOR to lab. This table will include columns for the chemical name, formula, molar mass (fw), density (g/mL) melting point or MP in °C, boiling point or BP in °C, solubility (what the substance is soluble in and how much if available) and hazards that may be encountered in working with the chemical. You may not begin the lab until you have this information.

Abstract: (right)

Tell the purpose of the lab in 1-3 sentences. What will you show? How will you do it? This goes directly across from the Chemical Information.

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Introduction: (right)

Research and background information necessary for understanding the concept to be investigated. Include any equations with explanations that may be used to interpret and analyze your results.

Hypothesis: (right)

Your prediction of the experimental outcome. Must be testable, and must be the main point of the investigation you are performing. *Not all labs will be investigative in nature so some will require no hypothesis.*

Materials: (right)

List, in 2 vertical columns, everything you will use. One column will be for Equipment and the other column will be for Chemicals. Chemicals are not washable and not returnable. Equipment must generally be cleaned and put away. There will be a few gray areas, such as for matches and filter paper.

Source and Safety: (right)

List safety precautions, and author, title, copyright, and page # for all works consulted.

Procedure: (right)

The procedure is written out carefully in numbered steps. Write the entire procedure on the right hand page, planning for the data collected at each step to be recorded immediately to the left on the left-hand page. The procedure must be so clear that you could hand your book to another student and they could replicate the lab exactly as you did it. If the procedure is changed in any way during lab, note it at the end of the procedure as follows:

Amended Procedure:

Step 6: 30 mL of water was used instead of 10 mL.

Data; Data Tables (left)

Prepare tables prior to coming to class, ready to record each observation and measurement. Observations such as “blue ppt” are qualitative data. Numerical data and measurements are quantitative data. There will usually be a separate table for each. Data must be recorded directly into the prepared tables and not onto a worksheet or other paper including paper towels.

Calculations (either side)

Done in 3 steps as in the examples done in class:

1. Tell what you are calculating (a phrase or sentence)
2. Tell how you are going to calculate it (eg, state the equation to be used)
3. Do the math, written horizontally, with units labeled, and arrive at a numerical value.

When the same calculation is repeated for many sets of data, always do at least one calculation as above as an example. Title it “Sample Calculation.” The rest may be done on your calculator.

Every time you do math of any type, it is considered a calculation and requires this 3-step explanation.

Calculations Table (either side)

This table is similar to the Data Table, except it contains values that you calculate from data collected in lab. As you complete a calculation, add the result to the table. This will help you organize your work. Often, the value you just calculated is used in the next step, and the table keeps it all handy.

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Data Analysis (either side)

- Answer any questions in the lab handout using complete sentences that tell the question as well as the answer.
- Explain and discuss your results. Calculations and the Calculations Table are included.
- Graph data if applicable.
- Discuss any potential sources of experimental error. Experimental error is anything inherent in the procedure, and is often something over which you have no control. For example, if your product sticks to the beaker and it is impossible to get it all out to weigh it, this is a source of error. Splashing some product onto the counter is a source of experimental error. Include a discussion of anything you noticed that may have affected your results, and how it may have affected your results.
- Experimental error is not a mistake made in calculations, or any type of math error; nor is it “we made a mistake in weighing.” If your results seem unreasonable, it’s your job to review your calculations for possible mathematical or conceptual errors. If data seems unreasonable or questionable, ask about it before leaving the lab. The instructor will assist you in troubleshooting these errors if you ask. No points are lost for asking questions about your work. Points are lost when you turn in incorrect or incomplete work.
- There is no such thing as “human error” in the laboratory report and any references to such will result in a deduction of points.

Conclusion (either side)

Address these issues:

1. State the goal of the experiment and tell if it was met. Why or why not?
2. Restate the hypothesis, if you needed one. Tell whether or not the hypothesis was Supported, refuted, or simply needs to be modified, and rewrite the hypothesis if necessary for further testing. .
3. Discuss modifications to this procedure and tell what you’d do differently next time, were you to repeat the experiment.
4. Discuss a further investigation you might do now, knowing what you know, or an application of the work you did, in real life, and why you would choose to investigate in such a manner. Be specific. Responses such as “do the lab again with different chemicals” will receive no credit.

Submitting Your Work:

Prelabs will be checked and scored as you work.

Data will be xeroxed and turned in at the end of class. Be sure to put your name, the date, and the experiment title on the top right hand corner.

The remainder of the lab will be turned in as a xerox copy of your lab book at the BEGINNING of the class in which it is due. Come to class with your copies already made. Class time will not be used for xeroxing. If your lab is late because you could not xerox it in time, it will be counted late. There is a xerox machine in the workroom of the lab for your use from 7 AM til 4 PM and there is one in the library you may use as well.

It is your responsibility to be sure that the pages you submit are clearly xeroxed and easily read. Be sure your name and the lab title are in the upper right corner of each page you submit.

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