

# THE LABORATORY NOTEBOOK

## **Introduction:**

You are required to keep a laboratory notebook in this class. The duplicate pages from that notebook will be collected and graded. In the real world of laboratory research, the notebook serves as the primary record of a scientist's work. All data, observations, and results from each experiment must be recorded directly in the notebook. There are four important standards that these lab notebooks must meet.

1. It must be an honest and accurate record of the work done and the results obtained.
2. It must be recorded as you perform the work. Data and observations are written in the notebook as the experiment occurs.
3. It must be a permanent record. Changes to the notebook can make it suspect with regard to the standards above. It must be written in pen. All corrections must be legible.
4. The record must be kept in such a way that a competent person familiar with the field can repeat the work based on the notebook.

Ordinarily, a laboratory notebook is for a scientist's own use. However, a company or research director/advisor will often keep the original copy for practical or legal reasons. Especially in commercial work, the notebook may become legal evidence in patent or copyright disputes. Reports on a scientist's work are almost always separate from the notebook. A report might take the form of a scientific paper, a written report to company management, or a legal report. A scientist uses the data and observations recorded in the notebook as the basis for these reports, but adds explanations and discussion of the work appropriate for the intended readers.

Your notebooks are monitored and graded to teach you the proper way to keep a notebook. To ensure that these standards are met, you are required to follow certain conventions regarding the keeping of laboratory notebooks. As you progress in your scientific education, you will learn additional requirements and best practices when keeping a proper laboratory notebook. One of the primary objectives in this course is to learn the fundamentals of good notebook practices.

As the semester progresses, you will be expected to write separate laboratory reports based on the data and observations that you recorded in your notebook during the performance of the experiment. The proper procedure for writing of this laboratory report will be discussed later in the semester.

In this course a separate data sheet is required at the end of each experiment. For the first few experiments you will be guided as how to prepare a proper data sheet.

**Format:**

There are many formats that are acceptable for lab notebooks in general. However, a company may require its employees to follow a standard format for their lab notebooks so that information can be found more easily. In the same way, it is useful to have everyone in the class use the same format. Therefore, in this class, we require you to follow a particular format that is described below. Failure to follow this format can result in point deductions when your lab notebooks are graded.

- Do not use the back of any page. Begin the first experiment on page 3, leaving pages 1 and 2 for a table of contents that you will build as you use the notebook. Your table of contents should include the title of each experiment and the number of the notebook page on which your description of that experiment begins. Each time that you begin a new experiment, make a table of contents entry for that experiment. Do not try to construct the table of contents ahead of time because changes may have to be made to it.
- Write in pen not pencil. When you make a ~~miskake~~ mistake, simply put a single line through the error, and write the correction after. The information that was stricken must still be legible. Do not totally [REDACTED] blank out or ~~scribble~~ scribble over a mistake. Do not use whiteout.
- Within your description of each experiment, keep each required section separate from the others. For example, don't mix data with procedures. Clearly label each section and separate it from other sections. Arrange the sections in the order prescribed and do not leave large blank spaces on a page. Do not skip any pages (except for the pages reserved for the table of contents).

Listed below are the different sections you must include in your lab notebook for each experiment. Additional instructions and comments on keeping the notebook follow each section. Before each lab period, complete sections 1-5 of your notebook for the experiment we are scheduled to do on that day. If you have not completed your notebook you will not be allowed to perform your experiment and you could lose the points for that experiment.

<b>1. Date</b>	There is a place for the date to be entered at the top of the page. This is the date on which you do the experiment. Enter the date on every page.
<b>2. Name</b>	Put your name in the space provided at the top of each page. If you work with a partner, also include your partner's name.
<b>3. Title of Experiment</b>	In this class you can use the title in the manual or the syllabus. Enter the title in the space marked "Experiment" at the top of the first page of your notebook write-up for each experiment. Your instructor may also require you to enter the title on subsequent pages. Even if he or she does not require it, it is a good idea to do this in case a duplicate page becomes separated from the rest of the pages after being removed from the notebook.

	There are spaces for the course and section at the top of each page also. Your instructor will let you know whether he or she requires you to use them.
<b>4. Purpose</b>	A brief description of the scientific purpose for doing the experiment serves as an introduction to the main body of the notebook write-up. It normally consists of one short paragraph of perhaps one to three sentences.
<b>5. Procedure</b>	Write a summarized description of the procedure that you will be using in the experiment. This section should be more than a handful of sentences but typically less than one page long. Include enough detail to allow a knowledgeable chemist to carry out the entire experiment just following your written procedure. Include enough detail to be able to perform the procedure but do not rewrite the procedure from the manual verbatim. The procedure should contain target volumes, masses and temperature. It should also specify any unique glassware or materials to be used. Drawings of set-ups are valuable when carrying out an unfamiliar method for the first time.
<b>6. Data and Observation</b>	<p>This section is always found in both lab notebooks and reports of working chemists. It is probably the most important section of any laboratory notebook.</p> <p>Include in this section all of the measurements (mass, volume, times, temperatures) along with units and clear identifiers that you make in the laboratory. If the procedure calls for 4 g of starting material and you weigh out 3.965 g, record that as your number, not 4.00. Write data down directly into your lab notebook. Do NOT write data down on scratch pieces of paper and later neatly transfer to notebook. The data needs to be recorded directly in the notebook as it is obtained.</p> <p>Be sure to include observations such things as color and phase of all starting materials and products. Record all changes such as colors, bubbling, a new phase, precipitations and temperature shifts such as if a flask gets cold or warm. Often observations are just as important as hard data. Many new discoveries were made based on keen observations. Your instructor will deduct points for few or no observations.</p>
<b>7. Conclusion</b>	After all of the data and observations have been collected, think about the experiment and whether the purpose was obtained. Make a brief, one to three sentence statement summarizing the findings and the success or failure of the stated objectives.
<b>8. Signature &amp; Date</b>	Print your name (as signature) and date each page of notebook completed.

Two examples of sample pages of lab notebook are included next.

Exp. No.	Experiment/Subject	Date	27	
Name	Lab Partner	Locker/ Desk No.	Course & Section No.	

Purpose: Learn what happens when active Group I or Group II metals react with water. Use an acid-base titration to determine the chemical formula of the product formed when calcium reacts with water.

Materials: Glazed weighing paper, forceps, 25-50 mL buret, Mossy zinc, fresh calcium turnings, 6 M HCl, 0.02 M HCl, 1% phenolphthalein indicator, 0.1% thymol blue indicator,  $\text{NaHCO}_3$ .

Observations:

1. The reaction of zinc and calcium with HCl and  $\text{H}_2\text{O}$ .

a) Zinc added to 6 M HCl in the test tube.



Zinc reacts quickly with HCl and forms bubbles of  $\text{H}_2$ . Also, the mixture produces heat.

b) When  $\text{H}_2$  in inverted test tube is brought near a flame

Pop sound is heard and the flame goes out.

c) When Ca is added to 6 M HCl calcium metal reacts vigorously with HCl and produces bubbles of  $\text{H}_2_{(g)}$ .



d) Compare the reaction of the gas collected from the calcium-HCl reaction with the reaction of hydrogen collected from the zinc-HCl reaction.

Pop sound heard when the gas collected from the calcium-HCl reaction was brought near a flame was loud than the zinc-HCl reaction.

Signature	Date	Witness/TA	Date
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Introduction: Determine the iodine / zinc mass ratio for zinc iodide, which is prepared by reacting zinc with iodine in solution.

Materials: Variable temperature electric hot plate, aluminium foil, glazed weighing paper, 20-mesh granular zinc,  $I_2(s)$ , methanol, 125 mL and 250 mL beaker, Erlenmeyer flask, Analytical balance.

Procedure: Weigh a clean, dry 125 mL flask. Record the mass of the empty flask. Reweigh  $2.0 \pm 0.1$  g of granular zinc. Add zinc metal to the flask and reweigh the flask. Record the mass of the flask + zinc. Add about 2 g of iodine crystals to the flask containing zinc.

### Observations and Calculations:

1. The reaction of iodine with zinc

(a) Mass of empty Erlenmeyer flask	31.081 g
(b) Mass of flask + zinc	32.225 g
(c) Mass of flask + zinc + iodine	33.241 g

After Reaction

(d) Mass of flask + unreacted zinc	31.959 g
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Initially the color of the solution changes to black. Solution is warm to touch.

Final color  $\rightarrow$  clear solution.

Signature

Date

Witness/TA

Date