LABORATORY REPORTS

A laboratory report is the means by which a researcher or research team communicates the result of an experiment or series of experiments to his/her colleagues. It is a summary of the important information which a researcher recorded in his/her laboratory notebook with detailed explanations of the results. Such reports are often communicated as research papers at scientific meetings or are published in scientific journals.

The laboratory report is the means by which your instructor can determine your comprehension of the scientific principles involved in an experiment as well as to evaluate your ability to make careful measurements and observations, to calculate numerical results, and to organize your experimental data.

ONE WEEK after you have completed each experiment, your team must hand in a laboratory report. The report should be written **neatly**, in **ink**, on 8½ x 11inch paper (with no ragged edges such as pages torn from a spiral notebook) and stapled together with a single staple in the upper left-hand corner. All graphs (when required) should be drawn on graph paper and clearly labeled. The report must be written in the third person (do not use: I, me, my, we, our, etc.) and should follow the guidelines given below. (NOTE: Your laboratory instructor may request that your reports differ from this format to fit the requirements for your particular laboratory course.)

FORMAT FOR CHEMISTRY LABORATORY REPORTS

1. *Introduction*

The introduction should start at the top of the first page and contains two parts, the object of the experiment and the theory.

a) The **Object** of the Experiment

The object is usually given in one or two sentences. It is a statement of why the experiment was performed and it may also include the result to be obtained. For example, in an experiment on density, the object could be stated as:

"*The object of this experiment was to determine the density of an unknown liquid and an unknown solid.*"

b) The **Theory**

This is a *short* discussion of the theory or principle(s) behind the experiment. This section should give definitions of terms and the formulas to be used for any calculations. It should also include a brief explanation of how the measurements are to be made. For example, in an experiment on density, the theory cold be written:

"*Density is defined as mass per unit of volume and can be calculated using the formula*:

$$Density = \frac{Mass}{Volume}$$

where the mass is measured in grams and the volume in cm^3. *In this experiment, the mass of the unknown sample was measured directly on the laboratory balance and its volume was determined using water displacement.*"

2. *Safety Precautions and Disposal*

This section should list any safety precautions that were observed in the handling and use of the chemical reagents along with any modifications of apparatus and set-ups for safety purposes.

Include any disposal information for chemical reagents or products for this experiment.

3. *Procedure*

This should be a *brief* description of what was done in the experiment. It should be about one paragraph in length. The procedure should contain enough information so that someone with training comparable to yours could repeat the experiment. **For the purpose of this course,** if you are using a commercial laboratory manual, you can state that

> *"The procedure followed was given in the experiment (tell title and source of the experiment) with the following changes (if any changes were made in class)"*

4. *Data and Results*

The data should be listed in tabular form, whenever possible, using the correct number of significant figures and including the proper units. When constructing the table for the data, arrange the numerical observations and results in the order they will be used in the calculations, not necessarily in the order recorded in the notebook. If properly recorded, the method of calculation, especially in the case of simple additions and subtractions, will be readily apparent.

An example of data listed in tabular form is shown below:

Mass of beaker and sample	58.453 g
Mass of beaker	55.937 g
Mass of sample	2.516 g

For the purpose of this course, if data pages were supplied with the experiment, you may include the data pages from the experiment **neatly filled in with all questions answered** for the Data and Results section.

Regardless of whether you use the data pages or you list the data in your own tables, you should also include a paragraph relating any observations which may be useful in explaining or interpreting your results. This paragraph can be labeled "**Observations**".

5. *Sample Calculations*

Show a sample calculation for each different type of computation used in calculating the results. Show the complete set-up including the formula used, the numerical substitution, and the final answer, all with the proper units. **Do not show the arithmetic**. You may omit simple additions and subtractions from the sample calculations. Generally, there is space on left on the experiment data pages for sample calculations.

A sample set-up 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)

6. *Discussion and Conclusions*

This section contains a discussion of the experiment and the results with respect to the object stated in the introduction. The type of conclusions you write will depend on the type of experiment that was performed, a measurement experiment, a principle experiment, or a preparation.

In a **measurement experiment** you are measuring quantities such as density, melting points or boiling points, specific heats, or other properties. For this type of experiment you would be concerned with the precision of your data and results between two or more trials and the accuracy of the final values in comparison with known or accepted values (if available). In this type of experiment, one often expresses the percent error of the measured value in relation to an accepted value using the formula:

$$percent\ error = \frac{\text{(accepted value - measured value)}}{\text{(accepted value)}} \times 100\%$$

In a **principle experiment** you are attempting to demonstrate that a principle, such as Boyle's Law for the pressure-volume relationship of a quantity of gas, is correct or that a hypothesis, such as the effects of chemicals on plant growth, is valid or invalid. For experiments such as these you would attempt to show how your data and results support (or do not support) the principle you are studying in addition to examining the precision of the data and the accuracy of the results.

In a **preparation**, you have prepared a specific compound or series of compounds. In your discussion you should review your yield data as well as any tests or observations that provide evidence that the compound(s) you have synthesized is the correct one, and you should be able to use the results of the tests to comment on the relative purity of the compound.

In all of the above types of experiments, your discussion should tell your major findings, what kind of accuracy was obtained, explain and discrepancies between experimental and expected results, and discuss possible errors which may contribute to poor results. In all cases, use your experimental data and observations to explain or support any statements you make.

7. *References*

List any books that were used in writing up the laboratory report, including the laboratory manual. Number the reference (if more than one) and use standard reference form:

Author (last name first), title (underlined), edition number (if second edition or later), publisher, place of publication, most recent year of publication, page numbers.

An example of a reference is:

"Smith, Jones, and Rogers, Chemical Laboratory Experiments, 3th Ed., College Publishing Co., Philadelphia, PA, 2001, pages 25-6".

Remember, the laboratory report should be a team effort. All members of the team should contribute to the report.

The laboratory report is part of your laboratory experiment. The experiment is **not** considered to be complete until the laboratory report has been received.

LATE LABORATORY REPORTS will be down-graded based on the number of days the report is late. Reports that are one week late will be graded on a pass/fail basis only (pass = "D"). Reports more than one week late may not be accepted, at your instructor's discretion, and you may be assigned a grade of "zero" for that experiment. (If you are absent on the day a laboratory report is due, take the report directly to your instructor on the day you return to school or leave it in his/her mailbox either in the laboratory or in the department office building.)

INCOMPLETE LABORATORY REPORTS will be returned ungraded with notations telling you why the report is incomplete. Rewrite the incomplete sections of the report or add the missing information as indicated by your instructor and resubmit it with the original incomplete report **WITHIN ONE WEEK** in order to obtain a grade. In many cases it will not be necessary to rewrite the entire report.