Pima Community College
West Campus

CHM 151IN Laboratory Schedule and Supplement
Fall 2009

Course Information:

Course Prefix/Number: **CHM 151 IN Lab**

Course Title**: General Chemistry I Laboratory**

Semester: **Fall 2009**

CRN (Section Code): **13997 or 13998**

Class Days/Times: **CRN 13997: M 11:50-2:30 p.m.**
CRN 13998: W 11:50-2:30 p.m.

Site/Room: **Sci K-221**

Instructor Information:

Name: **David A. Katz**

Office: **E-235**

US Mail: **Pima Community College**
2202 W. Anklam Rd.
Tucson, AZ 85709-0270

Phone/Voice Mail: **520-206-6044**

E-mail: **dkatz@pima.edu**

Availability: **Office hours**: **MW 8:30-9:30 a.m.; 3:00-4:00 p.m. TTh 11:00-12:00 a.m.; 3:30-4:30 p.m.**

Generally, in addition to my office hours, I am in the office at least 30 minutes before or after class (if I am not in the lab). I am also available by appointment.

Laboratory Manual: Selegue, Thomas, **General Chemistry in Action**, Hayden McNeil, 2008

Laboratory Notebook: You are required to have a laboratory notebook. The notebook may be a composition book with sewn-in pages, available at most area stores at an approximate cost in the range of $1.00 – $2.00.

Important: You must have access to a computer with Internet connections. Additional experiments not in the laboratory manual are available at www.chymist.com under the submenu “Pima Chem Courses” and “Chem 151”.

CHM 151IN Laboratory Schedule for Fall 2009

You are expected to read each experiment and check the safety precautions for all chemicals used in the experiments before coming to class. If you are not prepared for lab, you may be asked to leave and will receive a grade of zero for that laboratory experiment.

Laboratory reports follow the format outlined by your lab instructor. Data analysis calculations, graphs, and questions must be completed for each laboratory report. Only one report is required for each laboratory group unless otherwise specified by your instructor.

Reports are due no later than **one week** after the experiment is completed.

Laboratory reports are graded on a 10-point scale based on neatness, completion of data, and answers to questions. Missed or incomplete experiment reports may be graded as a zero. Choice labs count as a double experiment.

Week of	Days	Experiment
Aug. 26	Wed-Fri	No Lab
Aug. 31 – Sept. 4	Mon-Fri	Safety Lecture and Check-in
Sept. 8 - 14	Tue-Mon	Safety Test Extraction and Analysis of Plant Dyes: (Lab manual, page 1) Extraction and Filtration of the Dye and Analysis of the Dye Using Thin-layer Chromatography Analysis of the Dye Using Absorption Spectrophotometry Analysis of the Dye by Observation of Acid-base Properties
	Tue-Mon	Determination of an Empirical Formula (Lab manual, page 7)
Sept. 22 - 28	Tue-Mon	Precipitation Reactions and Pigments: (Lab manual, page 11) Precipitation Reactions Making a Pigment
Sept. 29 – Oct 5	Tue-Mon	Determination of Copper in an Alloy (Lab manual, page 39) Exploring the Copper Cycle Determination of Copper Using Wet Chemical Methods
Oct. 6 – 12	Tue-Mon	Determination of Ascorbic Acid in a Vitamin C Tablet (Lab Manual, page 21) Standardization of the Base and Determination of Ascorbic Acid by Acid-base Titration
Oct 13 – 19	Tue-Mon	Determination of Ascorbic Acid in a Vitamin C Tablet (Lab Manual, page 21) Determination of Ascorbic Acid by Redox Titration
Oct. 20 - 26	Tue-Mon	Determination of Iron in a Multivitamin Tablet (Lab manual, page 45)
Oct. 27 – Nov. 2	Tue-Mon	Measurement of the Heat Capacity of a Metal (Lab manual, page 53)
Nov. 3 - 9	Tue-Mon	Heat of Combustion of Magnesium (Lab Manual, page 61)
Nov. 11	Wed	Veteran's Day holiday – No Lab
Nov 12 - 18	Thur-Wed	Choice Lab
Nov 19 - 25	Thur-Wed	Choice Lab – completion of data collection (if necessary) Preparation of presentations

Nov 26 – 29	Thur-Sun	Thanksgiving holiday– No Lab
Nov. 30 – Dec 4	Mon-Fri	Choice Lab Presentations Lab Checkout
Dec. 7 - 11	Mon-Fri	Choice Lab Presentations Lab Checkout (if not completed the previous week)

Choice Labs will be selected from the following experiments:

Exp. 7. Qualitative Analysis: The Identification of Inorganic Unknowns, page 31.

Exp. 8. The Ideal Gas Law: Determination of a Molecular Weight, page 35.

Exp. 15. The Design of a Fireproof Safe, page 65.

LABORATORY SAFETY

Laboratory safety is a major component of working in a chemical laboratory. At the beginning of the semester, you are given a safety lecture and a safety exam. You are required to pass the laboratory exam with a grade of 90% or better.

You must abide by the safety rules during the semester. This includes wearing safety goggles when working with chemicals, wearing closed shoes, not sandals or flip-flops, appropriate dress, and following proper methods of chemical disposal. Non-compliance may result in you being asked to leave the laboratory with a grade of zero for that day.

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(s)** 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. **It is recommended that you look up and record this information prior to the laboratory experiment**.

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, or constructed using a program such as Excel, 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. 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.

LABORATORY REPORTS

CHM 151 is a science and engineering major class. You are expected to be able to write an organized laboratory report.

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.

A single laboratory report is required for each experiment. If an experiment is divided into two parts, the laboratory report is for the entire experiment.

ONE WEEK after you have completed each experiment, your team must hand in a laboratory report. The report should be written **neatly**, in **ink**, or printed 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 briefly 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 special 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 or Internet sites 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 more than one class late will be graded on a pass/fail basis only (pass = "D"). Reports more than two classes 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, email the report to your instructor or take the report directly to your instructor on the day you return to school or leave it in his/her mailbox in the department office building.)

INCOMPLETE LABORATORY REPORTS will be graded “as is” with points deducted for missing sections.