

**PRINCIPLES OF CHEMISTRY LABORATORY II**  
**CH114**  
**Spring 2001**

**Location:** GH 230

**Time:** Tue 8:00 to 11:00 AM – Tue 2:00 to 5:00 PM

**Course Coordinator** Dr. Guillermo Moyna      **Office:** GH 360      **Phone:** 8526  
**Email:** g.moyna@usip.edu

**Course Instructor:** Christine Schuller      **Office:** PTC 251      **Phone:** 1188  
**Email:** c.shulle@usip.edu

**Teaching Assistants:** Marianne Bush      **Email:** mbush1@erols.com  
Lauren McAllister      **Email:** lm0909@usip.edu

**Locker Number:** \_\_\_\_\_

Welcome to the Principles of Chemistry Laboratory! This laboratory sequence is designed to supplement your chemistry experience obtained in CH112. It has often been said that a picture is worth a thousand words. In a science such as chemistry, a hands-on laboratory experience, such as that provided by this course, may be worth many times more in helping you understand chemical principles than covering the same material in a lecture and/or a book alone. Hopefully, this laboratory will provide you with insight into chemical principles that make-up our world through hands-on experience and observations.

The labs for the first Principles of Chemistry series are the product of a lot of work from a lot of people. Although we will use a compilation of experiments that have been used in the past and in other institutions, most of them have been tested and modified by us. We are all grateful for the hard work of Sarah Chin and Phill Moravick, who fire-tested most of the experiments you will be performing. Many of experiments have been designed by USP faculty and student workers, and thanks are due to Dr. Rod Wigent, Dr. Mike Bruist, Dr. Gail Webster, and Kenneth Line for their efforts in the past semesters.

This laboratory is designed to help you learn certain laboratory and computer skills. You will learn about experimental design, and the collection, interpretation and reporting of data using principles of chemistry and the scientific method. All of skills that you learn in this laboratory will serve you well in both your academic and post-academic careers. Be sure to make good use of the problem solving skills that you will develop in the CH111 - CH112 course sequence in this laboratory.

Finally, as we did last semester, we will continue to include computerized data acquisition systems (the CBLs) for data logging and analysis in several experiments.

**Texts and Materials:** You are required to purchase the following materials for this course, which you may already have from the previous semester:

- 1) Chemistry in the Laboratory, Fifth Edition; Postma, J. M., Roberts, J. L., Hollenberg, J. L.; W. H. Freeman and Company, New York, 2000. Available at the USP Bookstore. This will be referred to as the **PRH Lab Manual**.
- 2) Laboratory Research Notebook with carbon paper.
- 3) Lab Kit including safety goggles.
- 4) TI-83 plus programmable calculator from Texas Instruments (also required for math courses).
- 5) Four 3.5" IBM-formatted floppy disk.
- 6) Combination lock.
- 7) Very important - e-mail address.

**E-Mail and Web-Page:** Everyone is going "e" and we will follow suit. Many times it is a lot harder trying to track down one of the lab instructors or TAs for a simple question than to sit down at the computer and type the question in. We will try to use e-mail as much as possible for communicating outside of the class, and we ask you that you try e-mail - it is a looooooot easier. Also, relevant information concerning the course will be posted at <http://tonga.usip.edu/gmoyna>, which will have a link to the CH114 web-page. Schedules, handouts, exercises, problems, etc., etc., will be posted regularly for you to download, print, and use. Unless the dog can eat the computer, you have no excuse for not having a handout...

Not only will you be able to download information from the course page, but in cases you will be required to submit your work (computer projects, lab reports) through e-mail. We believe that learning to master this form of communication is as important a skill as handling glassware and carrying out laboratory procedures.

**Attendance Policy:** Attendance in laboratory is required. A student should contact the course coordinator to arrange for a make-up of the laboratory, preferably prior to missing the laboratory. A student who misses more than two regularly scheduled laboratories during the semester or who fails to make-up a laboratory during the time scheduled by the course coordinator shall receive a grade of "F" for this course.

The prelab lecture is an extremely important component of this laboratory course. It is imperative that students show up to this lab on time. Students who are tardy by more than 5 minutes will be counted as absent for that laboratory even if the course instructor allows the student to complete the laboratory during the remainder of the time. No student will be allowed to remain in laboratory if they arrive more than 15 minutes late.

In order to perform an experiment in a safe and effective manner, the student must come to lab fully prepared. A student who arrives at the laboratory with out having the prelab questions completed, not attired properly or without proper safety goggles will be sent away from the laboratory and will be considered absent.

**Assignments:** Prelab questions and research notebooks will be checked before the student can start the experiment, usually during the prelab lecture. The student must

keep a proper notebook - the student and teaching assistant or instructor must sign and date the notebook at the end of each laboratory period only after the student has cleaned his laboratory space. Lab reports, data sheets, computer projects and any other assignments are due at the beginning of the laboratory period. For each 24 hour period that an assignment is late, a 25% penalty will be assessed. If an assignment is more than 4 days late, the student must still turn in a satisfactory assignment though it will count as zero points. All assignments must be completed and turned in by December 1<sup>st</sup> in order to receive a passing grade in this course. Unless otherwise stated, all assignments must be the student's own, individual effort.

Each student will have to turn in a total of four laboratory reports during the semester. Three will be individual reports and the fourth will be completed in groups. The instructor will let each person know at least a week in advance when their next lab report is due. The lab report must be the student's own work and must not be paraphrased from either the lab manual or some other persons work.

**Grading:** The student's grade for this course will be determined by summing the points earned by the student and dividing by the total points excluding any extra credit points. Approximately 80% of the grade will be based on the scores earned on assignments, lab reports, projects and unannounced quizzes (These quizzes may include information from past labs or material that the student was suppose to have read to prepare for lab.). Approximately 20% of the total points will come from an evaluation of the student's performance in the laboratory by the course instructor and teaching assistant. There will be no curving of the individual assignments or the final grade though there will be a chance to earn extra credit points throughout the semester. The course coordinator will convert the numerical score to a letter grade. Again, all assignments must be completed and submitted by December 1<sup>st</sup> in order to pass this course.

**Safety:** Above all else, the student is expected to conduct him or herself in a professional, safe manner. A student who does not follow the proper laboratory procedures or conducts themselves in the proper decorum will be penalized points, asked to leave the lab, or will fail the course. Misuse of equipment or performing unauthorized experiments will also have similar ramifications.

**Cheating:** Students who are caught cheating (e.g., making up results, copying or paraphrasing the work of others, etc.) will be brought before the Discipline Committee. If the student is found to be guilty, besides any sanctions assessed by the Discipline Committee, the student will receive a failing grade in this course.

## CONTRACT

1. I have read the First-Day Instructions in the "Chemistry in the Laboratory" Lab manual (pp. 3-21). I agree to follow these rules at all times. I understand that my grade will suffer and I may not pass this course if I fail to comply with these rules.
2. I will not eat, drink, chew gum, or smoke in the laboratory, computer room, equipment room or stockroom at any time. I will not even bring food or drink into these areas.
3. I agree to wear safety goggles at all times that I am in the laboratory, equipment room or stockroom unless I am exempted from this rule by the course instructor. After one warning, a violation of this policy will result in the immediate dismissal from this laboratory for the rest of the period and I will receive a grade of zero for this experiment, even though I must make arrangements with the course coordinator to make up this lab.
4. I agree not to perform any unauthorized experiments as these may be extremely hazardous.
5. I agree that I will be properly attired for the lab. I will not wear sandals or open-toed shoes while I am in the lab.
6. I will keep my lab-bench and all work areas clean and uncluttered. If I have a chemical spill, I will notify the teaching assistant or course instructor and receive instructions on how to clean up this spill.
7. I am aware of the location of safety equipment, such as fire extinguishers, safety showers and eye wash fountains, within the laboratory and know how to use them properly. I know the location of the Material Safety Data Sheets. I know the exits to use in case of a fire.
8. I will not mistreat the equipment that I use. I understand that I am financially liable for the repair or replacement of this equipment if I am found to be responsible for its damage.
9. I agree to conduct myself in a courteous and professional manner. I agree to pay attention to the instructions of the course coordinator, instructor and teaching assistant while I am in the laboratory.
10. I agree to complete the assignments to the best of my ability in a timely fashion.
11. I will not be more than 5 minutes tardy for this lab. If more than 15 minutes late, I recognize that I will not be allowed to participate in the laboratory during that day and must make up the lab.
12. I agree to be aware of the proper safety precautions in handling chemicals that I am using. I agree to follow proper chemical hygiene procedures - I will especially be certain to wash my hands before leaving the laboratory.
13. Finally, I will make every attempt to have fun and enjoy myself in this lab.

Name: \_\_\_\_\_ Signature: \_\_\_\_\_

Date: \_\_\_\_\_ Locker # \_\_\_\_\_ Locker Combination: \_\_\_\_\_

Lab Day: \_\_\_\_\_

## Lab Notebook

You must purchase a Laboratory Research Notebook with carbon paper. You must keep an organized notebook. Make sure your Name and address are written in ink on the outside cover. (Indeed, all entries must be made in ink - no pencil or erasable pen allowed.) Reserve the first two pages for a Table of Contents - keep this table updated. For each experiment, prior to coming to the lab:

- 1) write the title of the experiment you are going to perform, below the title note any lab partners that you have working with you and the date(s) in which the work is performed.
- 2) write a short objective (1 to 3 sentences) of the experiment(s). This should indicate what you are trying to accomplish in this work.
- 3) list the chemicals, their source and grade which will be used in this work (e.g., sodium chloride, Analytical Reagent grade, Fisher Scientific Co.).
- 4) write an outline of your experimental procedure which you plan to follow. Note where you obtained this information and list and modifications that you are made aware of (e.g., "This procedure was taken from the Chemistry in the Laboratory lab manual, Experiment 8, page 104; 3.0 g of granular zinc metal was used instead of 2.0 g as per the instructions of the lab instructor.").
- 5) prepare appropriate tables to record data. All data entries should be recorded directly into the notebook. Data must not be entered onto any other source before being entered into the lab notebook.
- 6) besides preparing tables for data entry, leave a space for making extra observations and notes during the course of the experiment.

The course instructor and/or teaching assistant will check your lab notebook at the beginning of the period to ensure that the lab book is complete. People with incomplete Lab notebooks will not be allowed to participate in the lab, will be counted absent for that day, must make arrangements to make up the lab, and will lose evaluation points.

During the laboratory make all data entries and observations directly into the notebook in ink in a neat and legible fashion. If you make a mistake in an entry, put a single line through the entry and write the correct entry next to the incorrect entry. If there is not enough room to make the correct entry, put an asterisk next to the incorrect entry and with an asterisk, identify the corrected entry in the space you allocated for additional observations.

At the end of the lab period, after you have cleaned up your bench area and lab drawer and have properly stored any equipment that you used during the lab, sign and date your notebook and have either the instructor or teaching assistant initial and date the notebook.

When you turn in a lab report and/or Lab Manual report sheets, also turn in the yellow carbon copy of the notebook for that experiment.

## Lab Reports

Lab reports are documents that provide detailed information on a specific experiment that allows a reasonably trained person to determine what you did, why you did it, how you did it, what results you obtained, and what conclusions you drew from this work. The lab report should include:

- 1) A title page that includes: a specific yet concise title of the experiment (often, the title of the experiment in the lab manual is too vague), your name and the names of your lab partners for this experiment, course number and date submitted.
- 2) An introduction, which states what your experimental objectives are and a concise explanation of the background to the theory which allows you to perform the experiment in this fashion. The background section often includes the derivation of any pertinent equations used in this experiment.
- 3) A materials and methods section. The materials section lists the chemicals (including water or other solvents), their chemical grade (e.g., certified reagent or analytical reagent), and the brand (e.g., Fisher Chemical Co.). The methods section describes each procedure that was used in the experiment, including the type of equipment (including make and model number) used in the experiment.
- 4) A results section, which lists the results of your experiment. Whenever possible, this should be done in tables and graphs which are numbered and labeled as well as described in writing. Remember when reporting a number, always try to give the precision of the value – this is usually done by reporting the standard deviation of the value (e.g.,  $45.13 \pm 0.05$ ).
- 5) A discussion section which describes what your results mean. Always attempt to interpret your results at the molecular level. What is happening chemically or physically that would explain your results? Did you obtain the results you expected? If not, why not? It is always a good idea to try to tie in your results in terms of the theories that you presented in the background section.
- 6) Finally, what conclusions can you draw from your work. Always relate your conclusion to your original experimental objectives.
- 7) References – you need to properly cite anything that is not your own work. We suggest that you use the ACS citation style. You might wish to examine a copy of an ACS journal, such as the Journal of Physical Chemistry, for a proper reference format.

For this class, the lab reports must be typed in a word processor. The report should be double spaced, and tables and graphs should be numbered and correctly labeled. The pages should be consecutively numbered starting with the Introduction section (i.e., the title page is not page one).

**CH114 PRINCIPLES OF CHEMISTRY LABORATORY II**  
**Spring 2001**  
**Schedule of Experiments (tentative)**

<b>Week</b>	<b>Laboratory Experiment</b>
<b>1/23</b>	Laboratory Check-In, contract, and other stuff. Computer Project I (assigned handout - Acid/Base Chemistry).
<b>1/30</b>	Determination of an Equilibrium Constant by Spectrophotometry. The Iron(III)-Thiocyanate Complex Ion (Exp. 24).
<b>2/6</b>	The pH Scale and Acid-Base Titrations. Standardization of NaOH Solutions. The Titration of Vinegar and Stomach Antacids. (Exp. 27 - CBL). Computer Project I due.
<b>2/13</b>	Determination of the Molar Mass and Ionization Constant of a Weak Acid (Exp. 28 - CBL).
<b>2/20</b>	Equilibria of Coordination Compounds (Exp. 42).
<b>2/27</b>	Electrochemical Cells (Exp. 39 - CBL).
<b>3/6</b>	Paper Chromatography in the Separation of Iron(III), Cobalt(II), Nickel(II), and Copper(II) Ions (Exp. 36).
<b>3/13</b>	Spring Break - No Labs
<b>3/19</b>	The Rate of a Chemical Reaction. Chemical Kinetics (Exp. 26).
<b>3/26</b>	The Chemistry of Vitamin C (Exp. 43).
<b>4/3</b>	The Synthesis of a Common Analgesic (Handout).
<b>4/10</b>	Colligative Properties. The Molar Mass of a Soluble Substance by Freezing Point Depression (Exp. 22 - CBL). Computer Project II (assigned handout - Chemical Kinetics).
<b>4/17</b>	Introduction to NMR Spectroscopy. Measurement of the Isotopic Ratio of $^{10}\text{B}/^{11}\text{B}$ of $\text{NaBH}_4$ .
<b>4/24</b>	Laboratory Check-Out. Computer Project II Due.
<b>5/1</b>	<b>ALL LATE ASSIGNMENTS DUE</b>