Analysis of Equilibrium Systems Laboratory
Chem 2041
Winter Quarter, 2013

GENERAL INFORMATION

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Teaching Assistants: There will be a Graduate Teaching Assistant (GTA) and an Undergraduate Teaching Assistant (UTA) in each lab section. These teaching assistants will have scheduled times that they will be available outside of lab to help you understand the concepts, perform calculations, etc.

Laboratory Manual:
Available on the CHEM 2041 Blackboard website.

Lab Notebook - All observations should be recorded in a bound laboratory notebook, or directly into the computer. If data is recorded into the computer, a paper copy (e.g., a print out) must be made before you leave the lab, and this becomes part of the lab notebook. The lab notebook specified for the course, available in the bookstore, makes two copies as you write. One of these copies stays in the bound book, and the other is turned in as part of your lab reports. The GTA must initial your lab notebook at the end of each lab session. It is your responsibility to show your notebook to the GTA and get it initialed.

Analysis of Equilibrium Systems (CHEM 2011/2041) provides an introduction to chemical equilibria and kinetics. The emphasis is on aqueous solutions because of their importance in living systems and in environmental science. CHEM 2011, Analysis of Equilibrium Systems, (the lecture course)is a corequisite for CHEM 2041 (the lab course) and students who register for 2041 are also expected to register for 2011.

Week of Experiment	
Jan. 7	Check in, Install software
Jan. 14	Glassware Calibration, Spreadsheets and Laboratory Data Analysis
Jan. 21	Standardization of HCl and NaOH
Jan. 28	Weak acid mixtures and Polyprotic Acids
Feb. 4	Determining Ksp
Feb. 11	Ascorbic Acid in vitamin tablets
Feb. 18	Separation of Copper from metals in an alloy.
Feb. 25	The Decolorization of Crystal Violet
Mar. 4	Lab Practical
Mar. 11	No lab

Computers
You will be using your laptop in the laboratory every week, including the first week.

How to succeed in this course
In prior years, some students have spent much more time in the laboratory than is intended, apparently largely because they were unprepared to do the laboratory work when they came to the lab, and/or did not think about what they were doing in the lab. You cannot successfully "cookbook" this lab or sleep-walk through it.

- Be prepared for lab sessions.
- Plan your work.
- Understand what concepts each laboratory experiment is intended to help you learn.
- Do the "Prelab" exercises well before the day of the laboratory.
- Understand the calculations you will perform to analyze your data, and how the data you will acquire is used in the calculations.

- Learn how to create Excel spreadsheets, perform calculations, plot graphs, etc.
- If an Excel spread sheet is going to be used in the lab, set it up before you come to lab.
- Think about what you are doing.
- Work safely. Think about the safety aspects of your actions.
- Follow the guidelines for writing in your lab notebook.
- Follow the guidelines for writing your lab reports.
- Answer all questions you are supposed to answer.

The lab final may involve giving you an "unknown" solution and instructions to perform the type of analysis you did in one of the lab sessions as appropriate to the sample. You will have to figure out by some simple measurements on the sample what type of sample it is, and thus, what type analysis you should perform. ***You will only be able to use your lab notebook for the lab final.***

Safety

- The lab manual contains some brief guidelines.
- The Graduate Teaching Assistant has absolute authority on matters of safety. If the GTA judges that you cannot work safely in the laboratory, you may be asked to leave the lab. No opportunity to make up a missed lab will be provided if you miss for safety reasons.
- Fashion changes faster than safety guidelines can be rewritten! Think. Layers of clothing are your primary protection against spilled reagents or broken glass. The laboratory is designed to minimize hazards, but safety is ultimately your responsibility.
- Since students in this lab work with aqueous solutions, experience is that wet floors are the major hazard. If you spill water on the floor, clean it up or call it to the attention of the GTA or UTA and warn other students who may be nearby.

Learning Goals

This is the course in the freshman/sophomore coordinated 6-quarter chemistry sequence in which you will learn about the species that exist in aqueous solution, and the equilibria involving these species. You will learn how to calculate and measure pH, solubility, and metal complexation equilibria.

Perform and preserve backups of your computer files. Disasters do happen with computers! It is your responsibility to be sure that you preserve all of the original data acquired in this course and files, such as Excel spread sheets, that you prepare. It is good practice to make a paper copy of spectra and spread sheets before you leave the lab. There is a campus printer available in Olin 105, to which you can print via Ethernet. If you do not have the appropriate software to use DU campus printers, you will need to obtain the software from the Help Desk in Penrose Library.

Working together

In several labs we will encourage you to share spectrometers, pH meters, burets, etc. For example, we will have 10 spectrometers and 10 pH measurement systems and possibly as many as 20 students in a lab section. For some titrations we will suggest that you share burets to save on reagents and save time. However, each student should record all data into their own laboratory notebook and into computer files as appropriate. When data is recorded in computer files, the laboratory notebook should describe the information in the computer file, and record the name of the file. A paper copy of the computer file should be printed and taped into the lab notebook, as well as turned in as part of your lab report.

Regardless of how much you are told to share or work together in acquiring data, your lab report is to be entirely your own work.

Spectrometers and pH Measurement Systems

The labs now have new ChemUSB CCD (charge-coupled device) spectrometers manufactured by Ocean Optics Inc., covering both UV and visible spectroscopy ranges. These spectrometers were obtained with a special grant from the Center for Teaching and Learning. Microelectronics make it possible for the spectrometer to be much smaller than your laptop computer. Indeed, your computer becomes part of the spectrometer system. Don't be misled by the small size - these are research-grade spectrometers, specially configured for use in undergraduate laboratories.

Instead of measuring just a number at a wavelength specified in a procedure, you will be able to measure the entire visible spectrum (400-850 nm) and select the spectral information appropriate to the problem you are trying to solve.

The USB in the name of the spectrometer refers to the fact that it will connect to your "laptop" computer via the USB port. Each student will load the software for the spectrometer on a laptop computer to be used throughout the course for both spectra acquisition and analysis. Assistance will be given during the first lab period. With this software you will operate the spectrometer,acquire data into your computer, and perform all necessary manipulations of the spectra. Each student should become familiar with the features of this software in order to optimize its use.

The pH meters have been replaced by a pH measurement system that also uses your laptop computer. Instead of writing down readings from the pH meter in your lab notebook, you will record the pH directly into your computer, using software that will plot the titration curve as you record the data. The system is made by a company called Vernier, the interface box is called LabPro and the software is called LoggerPro.

Blackboard
Class handouts and assignments will be available through the web on Blackboard.

If you miss a lab
If illness or a university-sponsored activity causes you to miss a lab, as early as possible seek to schedule a time that you can make it up during another regularly-scheduled lab (there are 9 each week). Except by special arrangement with the Graduate Teaching Assistant, reagents and apparatus will be available only during the week in which the lab is scheduled.

Deadlines
Prelab exercises must be completed before you come to the laboratory. Part of these exercises will be the viewing of specific video clips. You may be asked to answer a simple question for you Prelab to verify that you have viewed the video. A brief quiz at the start of lab may also be given. ***You will not be given credit for late Prelab exercises***. It is important that you write up your lab reports while information is fresh in your mind. Lab reports are due at the beginning of the lab period one week after you performed the lab. The GTA's will grade and return your lab reports at least 24 hours before your next lab report is due. This will give you time to make any last minutes corrections based on feedback from the GTA's.

Late lab reports will not be accepted.

Course Grading

Lab notebooks/technique		= 12 pts
prelabs	7 x 2 pt	= 14 pts
lab reports/Excel exercise	7 x 20 pt	= 140 pts
lab final - practical	1 x 24 pt	= 24 pts
total possible points		= **190 pts**