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CHEM 341.01: Quantitative and Instrumental Methods of Analysis

Michael D. DeGrandpre
University of Montana - Missoula, michael.degrandpre@umontana.edu

Chemistry 341
Quantitative and Instrumental Methods of Analysis

Fall Semester 2000

Professor: Michael DeGrandpre, aka Mike. Office: CP 313. Office hours are during the lab hours (Wed./Fri. 9-12 or 3-5) or by appointment (243-4118 or write mdegrand@selway.umt.edu). During lab I will be either in SC213 or CP313/314. Your teaching assistant will also have office hours (TBA).

Course objectives: With the ever-increasing importance of interdisciplinary research and the exponential rise of analytical biochemistry in biological sciences, it is more important than ever before for science students to develop good quantitative laboratory techniques. The humble goal of Chem 341 is to make you into good analytical chemists, or at least people who can confidently perform dilution calculations! The "quantitative laboratory skills" that we will focus on include sample and standard preparation, gravimetric and volumetric measurements, instrumental methods (e.g. potentiometry, absorbance and fluorescence spectrophotometry), data analysis with spreadsheet programs, and concise clear presentation and discussion of results. An additional objective near and dear to my heart is to help you develop a deeper understanding of the principles underlying quantitative chemical analysis. These topics fall mostly in the area of solution thermodynamics such as solubility and acid/base equilibria (buffers).

Texts: D.H. Harris, *Quantitative Chemical Analysis*, 5th ed. M.D. DeGrandpre, *Chem 341 Experimental Procedures FacPac*, 3rd ed.

Grading:
Labs (7), 700 pts (100 pts each)
Lab notebook, 50 pts
Homework problems, 50 pts
Quizzes (3) , 150 pts (50 pts each)
Final, 100 pts

As shown above, your overall course grade will mostly depend upon your laboratory work and your ability to calculate and clearly report the results. However, the quizzes and final are *moderately challenging* and can negatively impact your grade if you are not well prepared. The quizzes and final will focus on the more fundamental material

presented in the lecture. We cover about 14 Chapters in Harris, so keep up on the reading and homework or your quiz/final grade will suffer. Grade cutoffs are usually close to the traditional ranges: 100-90=A, 89-80=B, 79-70=C, 69-60=D, etc.

Laboratory notebook and reports: A bound laboratory notebook with page numbers is required. **You MUST have *and use* your lab notebook for all labs.** You will lose 5 pts from your lab notebook grade each time you do not have your notebook with you *and open* on the bench. Separate laboratory reports will be submitted for each lab. A detailed description of the laboratory notebook and report format will be given in class. All laboratory reports are due on the Wednesday following the final day of the experiment. Lab report grades will be reduced by 10% if they are late and will only be accepted up to 2 days after the due date (except in cases of illness or family emergency, explained to me prior to the deadline).

Other: Safety goggles are required for this course (**please see section below on lab safety**). Students are expected to adhere to the lab schedule. Lab make-ups will not be possible due to the limited availability of the lab.

	Chemistry 341 ***Lecture Schedule* (SS 352)** **Fall Semester 2000**	
Date	lecture subject	Reading
Wed. Sept. 6	course overview	Ch. 0-4
Wed. Sept. 13	review of data analysis methods	Ch. 1-4
Wed. Sept. 20	review of chemical equilibria (solubility calculations)	Ch. 6
Wed. Sept. 27	ion activities	Ch. 6,8
Wed. Oct. 4	chemical equilibria cont., **QUIZ #1**	Ch. 6,8,9
Wed. Oct. 11	spectrophotometry	Ch. 5,10,19
Wed. Oct. 18	solution of multiple equilibria (solubility, acid/base)	Ch. 9-10
Wed. Oct. 25	pH measurements	Ch. 9-10,15
Wed. Nov. 1	acid/base equilibria, **QUIZ #2**	Ch. 9-10,12
Wed. Nov. 8	acid/base equilibria (buffers)	Ch. 9-10,12
Wed. Nov. 15	EDTA titrations	Ch. 13
Wed. Nov. 22	Thanksgiving break, no lecture	all of above
Wed. Nov. 29	redox titrations	Ch. 16
Wed. Dec. 6	fluorescence spectrophotometry, **QUIZ #3**	Ch. 19
Wed. Dec. 13	wrap up and review for final	all of above
Thurs. Dec. 21	**Final Exam 1:10-3:10 pm**	

Chemistry 341
Lab Schedule (SC 213)
Fall Semester 2000

Date*	Lab Description	Reading
Wed. Sept. 6	no lab	Ch. 0-4
Fri. Sept. 8	check-in and lab overview	Ch. 0-4
Wed. Sept. 13	Lab #1 - Data analysis with spreadsheet programs (CP306)	Ch. 0-4
Fri. Sept. 15	Lab #1 - Volumetric and gravimetric measurements	Ch. 0-4
Wed. Sept. 20	Lab #1 - Volumetric and gravimetric measurements	Ch. 0-4
Fri. Sept. 22	Lab #1 - Volumetric and gravimetric measurements	Ch. 0-4
Wed. Sept. 27	Lab #2 - Gravimetric determination of chloride	Ch. 6,8,9,27
Fri. Sept. 29	Lab #2 - Gravimetric determination of chloride	Ch. 6,8,9,27
Wed. Oct. 4	Lab #2 - Gravimetric determination of chloride	Ch. 6,8,9,27
Fri. Oct. 6	Lab #2 - Gravimetric determination of chloride	Ch. 6,8,9,27
Wed. Oct. 11	Lab #3 - Spectrophotometric determination of Fe in vitamins	Ch. 5,10,19
Fri. Oct. 13	Lab #3 - Spectrophotometric determination of Fe in vitamins	Ch. 5,10,19
Wed. Oct. 18	Lab #3 - Spectrophotometric determination of Fe in vitamins	Ch. 5,10,19
Fri. Oct. 20	Lab #4 - Spectrophotometric determination of Mn in steel	Ch. 5,10,19
Wed. Oct. 25	Lab #4 - Spectrophotometric determination of Mn in steel	Ch. 5,10,19
Fri. Oct. 27	Lab #4 - Spectrophotometric determination of Mn in steel	Ch. 5,10,19
Wed. Nov. 1	Lab #5 - Acid-base analysis: the Gran plot	Ch. 9,10,12,15
Fri. Nov. 3	Lab #5 - Acid-base analysis: the Gran plot	Ch. 9,10,12 15
Wed. Nov. 8	Lab #5 - Acid-base analysis: the Gran plot	Ch. 9,10,12,15
Fri. Nov. 10	Lab #6 - EDTA titration of Ca and Mg in natural waters	Ch. 13
Wed. Nov. 15	Lab #6 - EDTA titration of Ca and Mg in natural waters	Ch. 13
Fri. Nov. 17	Lab #6 - EDTA titration of Ca and Mg in natural waters	Ch. 13
Wed. Nov. 22	Thanksgiving break, no lab	all of above
Fri. Nov. 24	Thanksgiving break, no lab	all of above
Wed. Nov. 29	Lab #7 - Fluorometric analysis of DNA	Ch. 5,19
Fri. Dec. 1	Lab #7 - Fluorometric analysis of DNA	Ch. 5,19
Wed. Dec. 6	Lab #7 - Fluorometric analysis of DNA	Ch. 5,19
Fri. Dec. 8	Lab #7 - Fluorometric analysis of DNA	Ch. 5,19
Wed. Dec. 13	check-out	
Fri. Dec. 15	lab will not be open	

* Lab reports are due on the first Wednesday following the final day of the experiment. Lab reports are docked 10% if they are up to two days late and will not be accepted if later than two days.

Spreadsheet Programs

Spreadsheet programs such as QuattroPro (QPro) and Excel will be used extensively in this course to document results, perform data analysis and prepare figures for reports. Both QuattroPro and Excel are widely available on computers throughout campus. The Chemistry Department has personal computers available in CP103 and CP306. The CP103 room schedule will be posted on the door during the first week of the semester. Computers in CP306 will be available ~8-5 Mon.-Fri. If you have any problems obtaining access to a computer please let me know.

Be aware that different computers have a wide variety of spreadsheet versions. Saving a file in the most recent version will not be readable by older software programs. Version 8.0 is our most recent version of QPro and Excel. All versions allow you to save files as an older version (e.g. v. 6.0) and I recommend you do this unless you are certain the computers you intend to use have the appropriate software. The same applies to word processing programs, as you may have already experienced!

A short spreadsheet tutorial will be given during the second week of lab to help you get started.

Safety

Corrosive acids and bases and many other dangerous chemicals are used in this lab. **YOU MUST WEAR SAFETY GOGGLES AT ALL TIMES!** A laboratory coat is also advisable, especially if you are concerned about damage to your clothing.

Use care to ensure your own safety as well as the safety of others. If you are uncertain about any procedure consult with the TA before proceeding. Misinterpretation of the lab instructions can result in a hazardous situation. There have been a number of accidents in this lab including acid burns and minor glass cuts. Please don't hurry and make sure you understand the lab procedure so that we can keep accidents to an absolute minimum!