

Chemistry 311

Quantitative and Instrumental Methods of Analysis

Fall Semester 2009

Professor: Chris Palmer Office: Chem. 203A. Office hours Mon/Tues 2:00-3:00 or by appointment (phone: 243-4079 or e-mail at christopher.palmer@umontana.edu).

Course objectives: This course has several significant practical objectives. The first is to prepare the student to perform careful, reproducible and accurate laboratory work. These are important practical skills that the student will ultimately need in order to perform well in any laboratory environment. A second objective is to develop skills to analyze and evaluate experimental data. The “quantitative laboratory skills” 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 is to develop a deeper understanding of the principles underlying quantitative chemical analysis, including solution thermodynamics and equilibria such as solubility, acid/base (buffers), and complexation.

Texts: D.H. Harris, *Quantitative Chemical Analysis*, 7th ed.

Grading: Labs (7), 700 pts (100 pts each)
Lab Notebook, 100 pts
Exams (3), 150 pts (50 pts each)
Final, 150 pts

Total: 1100 pts

Grading criteria is subject to change

Your overall course grade will depend strongly upon your laboratory work and your ability to calculate and clearly report results. However, the quizzes and final are *challenging* and can impact your grade. 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 do relevant homework problems or your quiz/final grade will suffer. Grade cutoffs are

usually close to the traditional ranges. The plus/minus system of grading will be used.

Laboratory notebook and reports: A bound laboratory notebook with page numbers is required. **You MUST have and use your lab notebook for all labs.** 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 prior to the deadline if possible).

Other: Safety goggles are required for this course and must be worn at all times. You will be working with strong acids and bases which can cause irreversible loss of eyesight and significant scarring. A lab coat is also recommended for those who wish to keep their clothing from mysteriously acquiring holes. Students are expected to adhere to the lab schedule. Lab make-ups will not be possible due to the limited availability of the lab. There is more than enough time devoted to each experiment and we are not responsible for poor time usage on your part.

Chemistry 311 Lecture Schedule (Chem 102) Fall Semester 2009		
Date	lecture subject	Reading
Mon. Aug. 31	Course overview and orientation, The Analytical Process	Ch 0
Wed. Sep. 2	The Analytical Process, Measurements and Units	Ch. 0,1
Mon Sept. 7	Holiday (No lecture)	
Wed. Sept. 9	Experimental Error and Significant Figures	Ch. 3
Mon Sept. 14	Statistics and Calibration	Ch. 4,5
Wed Sept. 16	Solubility Equilibria	Ch. 6
Mon Sept. 21	EXAM #1 (Chs 0-5)	
Wed Sept. 23	Equilibria, Activity and Activity Coefficients	Ch. 6,8
Mon Sept. 28	Systematic Treatment of Equilibria	Ch 8
Wed Sept. 30	Systematic Treatment of Equilibria	Ch 8
Mon Oct. 5	Titrations	Ch. 7
Wed Oct. 7	Spectroscopy	Ch. 18-20
Mon Oct. 12	Spectroscopy	Ch. 18-20
Wed Oct. 14	EXAM #2 (Chs 6-8,18-20)	
Mon Oct. 19	Acid/base equilibria and Titrations	Ch. 8-11
Wed Oct. 21	Acid/base equilibria and Titrations	Ch. 8-11
Mon Oct. 26	Acid/base equilibria and Titrations	Ch. 8-11
Wed Oct 28	EDTA titrations	Ch. 12
Mon Nov. 2	EDTA titrations	Ch. 12
Wed Nov. 4	EDTA Titrations	Ch. 12

Mon Nov. 9	EXAM #3 (Chs 8-12)	
Wed Nov. 11	Veteran's Day	
Mon Nov. 16	Electrochemistry	Ch. 14-15
Wed Nov. 18	Electrochemistry	Ch. 14-15
Mon Nov. 23	Electrochemistry/Titrations	Ch. 14-16
Wed Nov. 25	Thanksgiving	
Mon Nov. 30	Redox titrations	Ch. 16
Wed. Dec. 2	Fluorescence spectroscopy	Ch. 19
Mon Dec. 7	Fluorescence spectroscopy	Ch. 19
Wed. Dec. 9	wrap up and review for final	all of above
Tues. Dec. 15	Final Exam 1:10-3:10 pm	

Chemistry 311 Lab Schedule (SC 213) Fall Semester 2009		
Date*	Lab Description	Reading
Wed. Sep. 2	no lab	
Fri. Sep. 4	Lab overview, tools of analytical chemistry, check-in .	Ch. 2
Wed. Sept. 9	Lab #1 – Statistics, data analysis, and spreadsheet programs	Ch. 0-4
Fri. Sept. 11	Lab #1 – Volumetric and gravimetric measurements	Ch. 0-4
Wed. Sept. 16	Lab #1 – Spectrophotometric verification of pipettor performance	Ch. 0-5
Fri. Sept. 18	Lab #2 – Gravimetric determination of chloride	Ch. 6,8,9,27
Wed. Sept. 23	Lab #2 – Gravimetric determination of chloride	Ch. 6,8,9,27
Fri. Sept. 30	Lab #2 – Gravimetric determination of chloride	Ch. 6,8,9,27
Wed. Oct. 7	Lab #2 – Gravimetric determination of chloride	Ch. 6,8,9,27
Fri. Oct. 9	Lab #3 – Spectrophotometric determination of Fe	Ch. 4,5,18-20
Wed. Oct. 14	Lab #3 – Spectrophotometric determination of Fe	Ch. 4,5,18-20
Fri. Oct. 16	Lab #3 – Spectrophotometric determination of Fe	Ch. 4,5,18-20
Wed. Oct. 21	Lab #4 – Spectrophotometric determination of Mn in steel	Ch. 5,18,19,20
Fri. Oct. 23	Lab #4 – Spectrophotometric determination of Mn in steel	Ch. 5,18,19,20
Wed. Oct. 28	Lab #4 – Spectrophotometric determination of Mn in steel	Ch. 5,18,19,20
Fri. Oct. 30	Lab #5 – Acid-base analysis: the Gran plot	Ch. 7,8,9,11,15
Wed. Nov. 4	Lab #5 – Acid-base analysis: the Gran plot	Ch. 7,8,9,11,15
Fri. Nov. 6	Lab #5 – Acid-base analysis: the Gran plot	Ch. 7,8,9,11,15
Wed. Nov. 11	Veteran's Day	
Fri. Nov 13	Lab #6 – EDTA titration of Ca and Mg in natural waters	Ch. 13
Wed. Nov. 18	Lab #6 – EDTA titration of Ca and Mg in natural waters	Ch. 13
Fri. Nov. 20	Lab #6 – EDTA titration of Ca and Mg in natural waters	Ch. 13
Nov. 25-27	Thanksgiving Break, no lab	
Wed. Dec. 2	Lab #7 - Fluorometric analysis	Ch. 4,18,19,20
Fri. Dec. 4	Lab #7 - Fluorometric analysis	Ch. 4,18,19,20
Wed. Dec. 9	Lab #7 - Fluorometric analysis	Ch. 4,18,19,20
Fri. Dec. 11	check-out	