

Chemistry 311: Analytical Chemistry - Quantitative Analysis

Professor: Brooke Martin Office: Chem. 207. Office hours Mon. 2:00-3:00; Tuesday 11:00-12:00 or by appointment (e-mail at brooke.martin@umontana.edu).

Learning Outcomes: Quantitative laboratory skills include sample and standard preparation, gravimetric and volumetric measurements, instrumental methods (e.g. potentiometry, absorbance, and fluorescence spectrophotometry, liquid chromatography), data analysis with spreadsheet programs, and concise clear presentation and discussion of results. This course has several significant learning outcomes:

1. Prepare the student to perform careful, reproducible and accurate laboratory work: Important practical skills that the student will ultimately need in order to perform well in any laboratory environment.
2. Develop skills to analyze and evaluate experimental data.
3. Develop a deeper understanding of the principles underlying quantitative chemical analysis:
 - a. solution thermodynamics and equilibria
 - b. solubility calculations
 - c. acid/base and buffer calculations
 - d. metal complexation chemistry and calculations
 - e. gravimetric procedures and analysis
 - f. titrations and quantitative volumetric procedures and calculations
 - g. spectroscopy applications, procedures and calculations
 - h. chromatography applications, procedures and calculations

Text: David Harvey, *Analytical Chemistry 2.1*, Online edition
http://dpuadweb.depauw.edu/harvey_web/eTextProject/version_2.1.html

Homework: Sapling Learning online

Grading: Labs (8), 800 pts (100 pts each)
Lab Notebook, 100 pts
Homework, 150 pts
Exams (3), 300 pts (100 pts each)
Final (ACS standardized exam), 150pts

Total: 1500 pts

Your overall course grade will depend strongly upon your laboratory work and your ability to calculate and clearly report results. However, the exams and final are challenging and can impact your grade. The homework, exams and final will focus on the more fundamental material presented in the lecture. We cover about 11 Chapters in Harvey, so keep up on the reading and do relevant homework problems or your

exam/final grades will suffer. Grades will be curved but 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.** Your laboratory notebook represents the proof that you have done the work. If your notebook is incomplete or empty you have no evidence that you have completed the work. Separate laboratory *reports* will be submitted for each lab. A detailed description of the laboratory notebook and report format is provided on Moodle. All laboratory reports are to be submitted on Moodle and are due on the Wednesday following the final day of the experiment. Lab report grades will be reduced by 10%/day if they are late and will only be accepted up to 5 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.

Academic misconduct is subject to an academic penalty by the course instructor and/or disciplinary sanction by the University. Academic misconduct is defined as all forms of academic dishonesty. All of the academic policies found in the Student Conduct Code (<http://www.umt.edu/vpesa/documents/Student%20Conduct%20Code%20PDF-%20FINAL%208-27-13.pdf>) apply to this course.

Of particular relevance to this course, it is considered academic misconduct to represent another person's words, ideas, data, or materials as one's own. It is also considered academic misconduct to copy from another student's paper, consult unauthorized material, give information to another student or collaborate with one or more students without authorization during an examination or academic exercise without the instructor's permission.

Students with Disabilities: If you are a student with a disability and wish to discuss reasonable modifications for this course, contact me privately to discuss the specific modifications you wish to request. Please be advised I may request that you provide a letter from Disability Services for Students verifying your right to reasonable modifications. If you have not yet contacted Disability Services, located in Lommasson Center 154, please do so in order to verify your disability and to coordinate your reasonable modifications. For more information, visit the Disability Services website at <http://www.umt.edu/disability>.

Important Dates: Deadlines regarding registration, adding or dropping courses, or changing grading options for courses can be obtained from the Registrar on the following website: <http://www.umt.edu/registrar/students/dropadd.php>

Chemistry 311 Lecture Schedule (CHEM 102) Fall Semester 2014		Reading	
Date	lecture subject	Harvey 2.0	Harris 8th Ed.
Mon. Sept 4	Holiday (No lecture)		
Wed. Sept 6	Course overview, The Analytical Process, Measurements and Units	Ch. 1,2	Ch. 0,1
Mon. Sept 11	Experimental Error and Significant Figures	Ch. 3,4,5,7A,B	Ch. 3
Wed. Sept. 13	Statistics and Calibration	Ch. 3,4,5,7A,B	Ch. 4,5
Mon Sept. 18	Statistics and Calibration	Ch. 3,4,5,7A,B	Ch. 4,5
Wed Sept. 20	EXAM #1 (Chs 1-5, 7A-B)		
Mon Sept. 25	Solution Equilibria	Ch. 6	Ch. 6
Wed Sept. 27	Equilibria, Activity and Activity Coefficients	Ch. 6	Ch. 6,7
Mon Oct. 2	Activity and Activity Coefficients	Ch. 6I	Ch 7
Wed Oct. 4	Spectroscopy	Ch. 10A,B,C	Ch. 17-19
Mon Oct. 9	Spectroscopy	Ch. 10A,B,C	Ch. 17-19
Wed Oct. 11	Systematic Treatment of Equilibria	Ch 6G	Ch 7
Mon Oct. 16	Systematic Treatment of Equilibria	Ch 6G	Ch 7
Wed Oct. 18	Systematic Treatment of Equilibria	Ch. 6G,H	Ch. 7
Mon Oct. 23	EXAM #2 (Chs 6, 10A,B,C)		
Wed Oct. 25	Acid/base equilibria and Titrations	Ch. 6, 9A,B	Ch. 7-10
Mon Oct. 30	Acid/base equilibria and Titrations	Ch. 6, 9A,B	Ch. 7-10
Wed Nov. 1	Metal Complexation equilibria/EDTA titrations	Ch. 6, 9C	Ch. 11
Mon Nov. 6	Metal Complexation equilibria/EDTA titrations	Ch. 6, 9C	Ch. 11
Wed. Nov. 8	Metal Complexation equilibria/EDTA titrations	Ch. 6, 9C	Ch. 11
Mon Nov. 13	Electrochemistry/Redox Titrations	Ch. 11, 9D	Ch. 13-15
Wed Nov. 15	Electrochemistry/Redox Titrations	Ch. 11, 9D	Ch. 13-15
Mon Nov. 20	Electrochemistry/Redox Titrations	Ch. 11, 9D	Ch. 13-15
Wed Nov. 22	Thanksgiving		
Mon Nov. 27	EXAM #3 (Chs 6, 9, 11)		
Wed Nov 29	Fluorescence Spectroscopy	Ch. 10F	Ch. 18
Mon Dec. 4	Fluorescence Spectroscopy	Ch. 10F	Ch. 18
Wed. Dec. 6	Separations	Ch. 12A, B	Ch. 22
Mon Dec. 11	Separations/Liquid Chromatography	Ch. 12A,B,E,F	Ch. 22, 24
Wed. Dec 20	Final Exam 8:00 – 10:00 am		

**Chemistry 311
Lab Schedule (CHCB 213)
Fall Semester 2015**

Date*		Lab Description		Reading	
	no lab			Harvey, 2.0	Harris 8 th Ed.
Aug. 31-Sept. 1	Lab overview, tools of analytical chemistry, check-in.			Ch. 2	Ch. 2
Sept. 5-6	Lab #1 – Statistics, data analysis, and spreadsheet programs			Ch. 1-5	Ch. 0-4
Sept. 7-8	Lab #1 – Volumetric and gravimetric measurements			Ch. 1-5	Ch. 0-4
Sept. 12-13	Lab #1 – Spectrophotometric verification of pipettor performance			Ch. 1-5, 8	Ch. 0-5
Sept. 14-15	Lab #2 – Gravimetric determination of chloride			Ch. 6,8	Ch. 6,7,8,26
Sept. 19-20	Lab #2 – Gravimetric determination of chloride			Ch. 6,8	Ch. 6,7,8,26
Sept. 21-22	Lab #2 – Gravimetric determination of chloride			Ch. 6,8	Ch. 6,7,8,26
Sept. 26-27	Lab #2 – Gravimetric determination of chloride			Ch. 6,8	Ch. 6,7,8,26
Sept. 28-29	Lab #3 – Spectrophotometric determination of Fe			Ch. 10	Ch. 4,5,17-19
Oct. 3-4	Lab #3 – Spectrophotometric determination of Fe			Ch. 10	Ch. 4,5,17-19
Oct. 5-6	Lab #3 – Spectrophotometric determination of Fe			Ch. 10	Ch. 4,5,17-19
Oct. 10-11	Lab #4 – Spectrophotometric determination of Mn in steel			Ch. 10	Ch. 5,17-19
Oct. 12-13	Lab #4 – Spectrophotometric determination of Mn in steel			Ch. 10	Ch. 5,17-19
Oct. 17-18	Lab #4 – Spectrophotometric determination of Mn in steel			Ch. 10	Ch. 5,17-19
Oct. 19-20	Lab #5 – Acid-base analysis: the Gran plot			Ch. 9	Ch. 6,7,8,10,14
Oct. 24-25	Lab #5 – Acid-base analysis: the Gran plot			Ch. 9	Ch. 6,7,8,10,14
Oct. 26-27	Lab #5 – Acid-base analysis: the Gran plot			Ch. 9	Ch. 6,7,8,10,14
Oct. 31-Nov. 1	Lab #6 – EDTA titration of Ca and Mg in natural waters			Ch. 9	Ch. 12
Nov. 2-3	Lab #6 - EDTA titration of Ca and Mg in natural waters			Ch. 9	Ch. 12
Nov. 7-8	Lab #6 – EDTA titration of Ca and Mg in natural waters			Ch. 9	Ch. 12
Nov. 9	Lab #6 – EDTA titration of Ca and Mg in natural waters			Ch. 9	Ch. 12
Nov. 10	Holiday – Veteran’s Day				
Nov 14-21	Lab #7 - Fluorimetry/ Lab #8 HPLC			Ch. 10/12	Ch. 17-19/22,24
Nov. 22-24	Thanksgiving Break, no lab				
Nov. 28 -Dec. 6	Lab #7 - Fluorimetry /Lab #8 HPLC			Ch. 10/12	Ch. 17-19/22,24
Dec. 7-8	check-out				