Chemistry 3000
Quantitative Chemical Analysis
Fall 2015

Course: Quantitative Chemical Analysis

Time/Location: MWF 12:30-1:20, Engineering 106

Instructor: Prof Stephen E Bialkowski, PhD

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Student Office Hours: MW 1:30-2:20 p.m. I also will around most of the time the Chemistry 3610 and 3080 laboratories are running. It is easy to find me in my office then. Other arrangements may be made. E-mail questions works very well. Please do not come before class. I will be preparing for lecture during this time.

Required Text: Daniel C. Harris *Quantitative Chemical Analysis* 8th Edition, W. H. Freeman and Company, New York **2010**

Course Content: This is a lecture course addressing aspects of modern chemical analysis with emphasis on chemical equilibrium. Volumetric, gravimetric, and instrumental methods are described.

Lectures: Lectures will cover basic statistics, chemical equilibrium, gravimetric analysis, volumetric analysis, acid-base chemistry, complexation, spectrophotometry, and separations.

Homework: Students should review *all Exercises* at the end of each Chapter. Certain Problems will be assigned. These Problems should be worked for your own benefit. It is not necessary to work all Problems if you have a good grasp of the concepts and computation skills. This homework will not be graded but the successful student should work them through and check the results.

Note on Harris's Quantitative Analysis: Please read the chapters prior to coming to class for the lecture. Be sure to read the ***Summary*** and ***Terms to Understand*** sections at the end of the chapters both before and after reading the chapters.

Examinations: There will be two in-class examinations and a final examination. They are equal-weighted. The in-class examinations will be based on homework (Exercises and assigned Problems) and/or concepts addressed in the lectures. The test questions may be taken from the homework verbatim, or may be altered to have different numerical values or reagents. Questions can be synthesized from several homework problems. An American Chemical Society standardized final will be used for course assessment and performance evaluation purposes.

Canvas: There is an active course page on the USU Canvas web site. PDF files of Power Point lectures and exam keys will appear there: https://usu.instructure.com/

Grading: Grades will be based on your performance on the three examinations. Point scores will be added and a percent score calculated. The guaranteed grade cut-off of 90+% A, 80%-89% B, 70%-79% C, 55%-69% D will be used. +/- scores will be used as prescribed in the Catalog. The percentile scores may be adjusted, only upward, to curve the percent scores *if* the examinations appear to be too difficult and if the class, as a whole, did not perform well on specific questions. Past experience has shown that those students who do the homework and understand what they have done pass with high scores.

Withdrawal Policy: This course will follow the University policy on withdrawals stated in the current Undergraduate Catalog. Drop dates are listed in the Schedule of Classes.

Missed Examination Policy: Students may be excused from an examination in cases of emergency. Documentation must be supplied to be excused. In cases of excused absence, grades will be assigned based on % of adjusted total score. No repetition of examinations is permitted.

Attendance Policy: Attendance will not be taken. Attendance is mandatory for successful performance in this course.

Student Disability Statement: Any student with a disability that requires accommodations must contact the Instructor. The disability must be documented by the Disability Resource Center. Course materials may be requested in alternative formats.

Learning Objectives:
- Comprehend the importance of stoichiometry, chemical equilibrium and kinetics in analysis.
- Formulate concepts of validation of data and experimental design
- Comprehend concept of and perform chemical measurement calibration
- Apply and assess concepts of availability and evaluation of analytical standards and formulate standardization methodology
- Demonstrate knowledge of sampling methods for all states of matter
- Use statistical methods for evaluating and interpreting data
- Assess sources of error in chemical and instrumental analysis and account for errors in data analysis
- Recognize interferences in chemical and instrumental analysis
- Apply theory and operational principles of analytical instruments
- Distinguish between qualitative and quantitative measurements and compare and critically select methods for elemental and molecular analyses
- Professional Ethics

Tentative Lecture Schedule

Dates	**Subject**	**Reading**	**Additional Homework***
8/31-9/2	Analytical Process	Ch. 0 & 1	0-2, 0-4, 1-12, 13, 18, 28, 31
9/3-9/11	***No Class***		
9/14-9/16	Experimental Error	Ch. 3	3-7, 10, 13, 16
9/16-9/18	Statistics Review	Ch. 4	4-1, 8, 11, 13, 20, 22
9/18-9/21	Quality Assurance/Calibration	Ch. 5	5-2, 9, 11, 14, 18, 32
9/23-9/25	Chemical Equilibrium	Ch. 6	6-4, 6, 8, 14, 19, 25, 36, 48
9/28-9/30	Gravimetric Analysis	Ch. 26	26-10, 22, 36
10/2-10/5	Activity-Systematic Equilibria	Ch. 7	7-3, 4, 12, 18, 23, 30
10/7	***First Examination***		***Ch. 0 through Ch. 7 plus Ch. 26***
10/9	Monoprotic Acid-Base	Ch. 8	8-2, 3, 11, 20, 32, 39
10/12-10/14	Polyprotic Acid-Base	Ch. 9	9-4, 11, 13, 25, 31
10/15 10/16	***Fall Break - Meet 10/16***		
10/15-19/19	Acid-Base Titrations	Ch. 10	10-2, 6, 12, 15, 19, 31, 45
10/21	EDTA Titrations	Ch. 11	11-2, 3, 6, 30, 36
10/23	Electrochemistry	Ch. 13	13-1, 5, 10, 17, 26
10/26-10/28	Potentiometry	Ch. 14	14-2, 4, 6, 20, 28, 35, 41
10/30-11/2	Spectrophotometry	Ch. 17	17-4, 6, 11, 15, 19, 28
11/4	***Second Examination***		***Ch. 8 through Ch. 17***
11/6-11/9	Applied Spectrophotometry	Ch. 18	18-2, 3, 19, 21
11/11-11/13	Atomic Spectroscopy	Ch. 20	20-2, 4, 20, 21
11/16	Mass Spectrometry	Ch. 21	21-2, 5, 14, 27
11/18-11/20	Analytical Separations	Ch. 22	22-7, 16, 18, 28, 35, 40, 45
11/25-11/27	***Turkey Break***		
11/30-12/2	Gas Chromatography (GC)	Ch. 23	23-2, 9, 19, 24, 28
12/4-12/7	HPLC	Ch. 24	24-4, 11, 15, 19
12/9-12/11	Chromatographic Methods	Ch. 25	25-4, 7, 13, 14, 17, 18
12/16	***Final Examination*** **Wednesday 11:30-1:20**		***Comprehensive***

* In addition to all Exercises at the end of each chapter.