

Goals and requirements of the course

Modern science and technology cannot sustain without quantitative chemical analysis. Precise and accurate measurement of chemical species and chemical analysis of material composition are required by all branches of science. This course is designed to introduce the process and method of chemical analysis - in theory and practice. Since many of you are going to work as a professional chemist, biologist, doctor, environmental scientist, etc., therefore, it is to your advantage to learn one of the most vital tools of the trade i.e., chemical analysis. Students must have passed and learned the general chemistry (CHEM 211 and CHEM 212) to take this course. Students are expected to know and use word processing and spreadsheet programs to write laboratory reports, process laboratory data and solve assigned projects.

Text

Exploring Chemical Analysis (Fifth Edition) by Daniel C. Harris, W. H. Freeman, 2013 and web materials at www.whfreeman.com/exploringchem5e. A solution manual for the text is also available for purchase.

Course content

The course is designed to solve problems of practical significance. Particular emphasis will be given on error analysis, chemical equilibria, electrochemical techniques, basic spectrophotometry and separation science. A tentative course schedule is given below. Materials covered in class and a detail syllabus is posted as we proceed.

Lecture	Subject	Chapter	Dates	Quiz
1-3	Analytical Process, Concentration units, Experimental errors, significant figures, error propagation and math toolkit Tools of the trade (Ch 2: A must lab reading material)	0-3	August 28- Sept 6	
4-5	Statistics: Error distribution, t-test, Q-test, calibration curves, linear best fit line. Quality assurance and calibration methods	4-5	Sept 11,13	
6-7	Volumetric analysis: solubility products, Gravimetric analysis, Relation between K's (part from chapter 1-5)	6,7	Sept 18,20	
8	Monoprotic acid-base equilibria	8	Sept 25,27	
9	Buffers and Indicators	9	Oct 2,4	
10	Acid-base titration	10	Oct 9,11	
	Midterm Exam		Oct 16	
11,12	Polyprotic acid base: Speciation analysis, Deeper Look	11,12	Oct 18,23	
13	EDTA Titration of Metal ions	13	Oct 25	
14	Electrode Potential	14	Oct 30, Nov 1	
15	Electrode Measurement, Redox Titration	15,16	Nov 6,8	
18,19	Spectrophotometry: Instrument and Application	18,19	Nov 13,15	
21,22	Principles of Chromatography	21,22	Nov 20,27	
23,24	Gas / liquid chromatography, Capillary Electrophoresis	23	Dec 4,6	

Columbus Day: Monday, Oct 9 (Monday classes meet Tuesday)
Midterm exam: Monday, Oct 16, 9:00-10:15 AM.
Last day of class: Dec 6, 2016
Final exam: Monday, Dec 18, 7:30-10:15 AM

Methods of evaluation

Course evaluation and grading are based on homework problems, computer projects, and class quizzes (25%), midterm (15%), cumulative course final exam (20%), and laboratory grade (40%). Exams and quizzes are designed to test your problem solving skills. All exams and quizzes are closed book and closed notes, without multiple choice questions. Lab grades may include pre-lab quiz, lab report, and lab final exam grades. There will be no makeup exams, quizzes, and labs except under circumstances determined by the instructor. Tentative grading scale: (A+) > 90, (A) >85-90, (A-) >80-85, (B) >70-80, (C) 60 -70, (D) <60

Methods of instruction

'Chalk-Talk' and overheads are the primary methods of instruction. Laboratory part of the instruction is based on handling wide range of laboratory chemicals, apparatus, and instruments. Instructor posts materials on web as necessary.

Methods of your learning

Attend class, listen to the lectures, keep a thorough class note, learn from solved problems, example problems, and “ask yourself question”. Pay attention to the problems and topics discussed in class. Learn by yourself first before in a group.

Home-study Problems: (Exams and quizzes are based on examples, “Ask yourself question” and HW problems)

Chapter	Topics	Problems
1	Chemical measurements	14,17,23,27,31
3	Math toolkits	13, 15,20
4	Statistics	10,13
5	Quality assurance and calibration methods	11, 14
6	Good Titrations: Solubility Products	5, 10, 17, 20
8	Acids and Bases (Calculate concentrations of all species not just pH)	6, 10, 21, 25, 30 Handout problems
9	Buffers (Do not use Henderson)	3, 10, 20
10	Acid Base Titration	8, 16, Handout problems
11	Polyprotic acid	7, 14, 23, 31
12	A deeper look at chemical equilibrium	11, 18, 22, 29, 33
13	EDTA Titration	8, 20
14	Electrode Potential	13,15, Handout problems
15	Electrode Measurement	15, 17,20
18	Let there be light: Spectrophotometry	15, 19,20
19	Spectrophotometry: Applications	4, 9, 21

Homework problems are not collected for grading except those handout problems. Check the solution manual for details. Problems from chapters on separation chemistry will be assigned later.

Computer Spreadsheet Project Problems

Topics	Chapter, Problems	Due Dates*
Math Toolkit	3-17, 3-24	
Statistics	4-19, 4-20	
More Stat Project	Handout and data from instructor	
Quality assurance and calibration methods	5-12	
Solubility products	6-24 (Lead phosphate)	
Acid Base Titration	10-30	
Polyprotic acid	Handout and data from instructor	
Electrode measurement	15-6 (X'l plot)	
Redox titration	16-7(X'l plot)	
Spectrophotometry	18-24	
Spectrophotometry: Applications	19-14	

***Announced in class.**