

# Syllabus for Chem 230-A: Quantitative Analysis

Fall 2013, CRN 10138

Tuesdays and Thursdays, 9:30 – 10:50 AM, Curtis 341

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**Welcome!** It's my pleasure to have the opportunity to introduce you to the exciting and challenging world of quantitative chemical analysis.

**Office Hours:** Mondays 4:30 – 5:45 PM in **Disque 212**. To the best of my knowledge, nearly every student can come for at least 30 minutes.

**Texts/Resources:** Please obtain *your own electronic or printed copy* of the *required text*, Quantitative Chemical Analysis, 8th edition (© 2010), written by Daniel C. Harris, and published by W. H. Freeman and Company. The *eBook* is available for \$50.00 from Sapling Learning (<http://www.saplinglearning.com>) if it is bundled with access to the Sapling homework website, for a total cost of \$74.99; the *printed textbook* is available from various on-line sources (both new and used copies), but if you choose to purchase a printed textbook on-line be sure to confirm rapid delivery before you buy.

Both graded and practice homework questions are provided by Sapling Learning, <http://www.saplinglearning.com>. The cost for access to the Sapling homework website by itself is \$24.99; if the eBook and Sapling access are purchased simultaneously through the Sapling website, the cost is \$74.99.

Please be sure to also visit the website for the *textbook* (“<http://bcs.whfreeman.com/qca8e>”) and take advantage of the following additional resources: On-line Quizzes, Chemical Analysis on the Web, Excel spreadsheets, Living Graphs, Spreadsheets, Living Graphs, and Chemical Analysis on the Web.

*Lecture notes* are usually posted in advance on Bb Learn and are sometimes updated slightly after the lecture based on student feedback.

## Course objectives

To understand the goals of analytical chemistry, i.e., the questions analytical chemists seek to answer, and the steps required to perform quantitative analysis.

To understand how chemical reactions may be utilized for the quantitative measurement of one or more compounds (analytes) in a sample.

To develop critical reasoning skills so that a student can calculate *the concentration of analyte in an unknown sample* (and the associated uncertainty, when applicable), given an appropriate set of data.

To develop a greater understanding of relevant chemical equilibria (solubility, acid-base, complexation, and oxidation/reduction), and to apply this knowledge in solving different types of equilibrium-based problems (pH, principal species, fractional composition, etc.).

To understand how selected forms of instrumental analysis (i.e., potentiometry, spectrophotometry, mass spectrometry, and chromatography) and the underlying methods of calibration (external standards, standard addition, and internal standardization) may be utilized for quantitative measurements in each.

To understand the difference between accuracy and precision and the figures of merit used to quantify them (relative error and relative standard deviation).

To be able to perform basic statistical tests such as the Grubbs-test, the t-test, and the F-test on one or more sets of data.

**Exam attendance policy:** If you cannot attend a scheduled exam, you must notify me in advance. If no such notification is received beforehand and no acceptable excuse is given afterwards, you will receive a zero (0) for the exam and, most likely, a failing grade (“F”) for the course.

**In-class exercises:** More often than not, there will be at least one in-class exercise each time we meet for class. As long as you are visibly trying to work on an in-class exercise when it is assigned (please bring a calculator or laptop), you will receive full credit regardless of whether you finished it or got the correct answer. On the other hand, if you are absent from class on a day in which an in-class exercise is assigned, you will receive a score zero (0) for that exercise.

**Grading:** Your course grade will be determined as outlined below. *The percentages are approximate ( $\pm 5\%$ ).*

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|--|------|
| On-line homework   | 25 % |
| In-class exercises   | 6 %  |
| On-line quiz (October 3, 2013)                                 | 4 %  |
| Exam 1 (October 17, 2013)                                      | 20 % |
| Exam 2 (November 19, 2013)                                     | 20 % |
| FINAL EXAM (December 9-13, 2013; time, date, and location TBA) | 25 % |

**Grading scale:** The standard Drexel grading scale is employed, i.e.,  $\geq 97 = \text{“A+”}$ ,  $93-96 = \text{“A”}$ ,  $90-92 = \text{“A-”}$ , etc.

**Recitations:** There are two recitation sections for this course, and they are scheduled on Fridays and Mondays from 11:00-11:50 AM. To avoid overcrowding, please attend only the recitation section for which you are registered.

**Reading assignments:** You are expected to read the assigned material *prior* to the class in which it is scheduled to be discussed. These assignments will be posted on Sapling Learning. If only part of a chapter is assigned, those sections are specified in parentheses. Supplemental reading (i.e., materials not contained in the textbook) may also be assigned occasionally during the semester.

**On-line homework problems from Sapling Learning:** You are responsible for working each assigned homework problem by the deadline specified on Sapling Learning. At the present time, there is no automated procedure for extending a homework deadline, so please plan to do all of your assignment or at least as much as you can by the deadline.

**Exercises and problems from your textbook:** Assigned exercises and problems from your textbook (not the Sapling website) are *strictly optional*, but will frequently be used in a slightly modified way on quizzes and exams as a reward to the students who work them in a faithful manner.

**In-class exercises:** Short in-class exercises will be assigned spontaneously to allow students to test their understanding of a recently introduced concept/topic. Students will be given full credit for doing the exercise, regardless of whether their answer is correct. Students who do not attempt the exercise will receive a zero for the exercise.

***Missed exams.*** *If you cannot attend a scheduled exam, you must notify me in advance.* If no such notification is given before the exam and no *acceptable* excuse is given afterwards, you will receive a zero (0) for the exam and most likely, an F for the course. ***The instructor, not the student, determines whether or not the missed exam is excused.*** For students with an excused absence, a missed exam will not be included in the term average, i.e., ***there are no make-up exams*** except under extremely unusual circumstances.

*Please do not come to see me about graded quizzes or exams until at least one day after they have been returned.* Note, however, that all questions concerning grades must be asked within 10 days after the quiz or exam is returned.

**More on the on-line homework:** Your on-line homework is available from Sapling Learning, <http://www.SaplingLearning.com>. ***Due dates for the on-line homework are firm and are specified on Sapling Learning; please submit the answers to as many of the assigned problems as possible by the deadline for that assignment.*** Please be sure to access Sapling Learning at least 3-4 times per week to ensure that you keep up with the deadlines for your on-line homework assignments.

**Sign-up instructions for Chem 230 on Sapling Learning:**

1. Please follow the instructions posted on the Sapling Learning website (<https://www.saplinglearning.com>).
2. Once you have registered and enrolled, you can login at any time to complete or review your homework assignments.
3. If you have any problems, you have the following three options:
  - a) **Online help at the website:** <https://www.saplinglearning.com/help/>
  - b) **Send an email to [support@saplinglearning.com](mailto:support@saplinglearning.com) explaining the issue(s).**
  - c) **Phone support: (512) 323-6565.**

**Communication by Bb Learn, Sapling Learning and e-mail:** It is VERY important for me to be able to communicate with each member of the class quickly and efficiently. ***Reading and on-line homework assignments are posted on Sapling Learning.*** Office hours and in-class exam topics are posted on Bb Learn (Calendar module); use the “Create printable view” feature of the Calendar to generate a cumulative list.

***Please be sure to check Sapling Learning and Bb Learn 3-4 times a week, e.g., Monday, Wednesday, Friday, and Sunday.*** If you have a question about an assignment, please be prepared to ask me about it in class on Tuesday or Thursday morning.

You are also welcome to submit a question about Chem 230 to me at [jfoley@drexel.edu](mailto:jfoley@drexel.edu). If the number of questions submitted by email is not too large, I will reply by email and distribute the answer to the entire class (without revealing your identity!).

**If you use an email address or alias other than your official Drexel email address (“firstname.middleinitial.lastname@drexel.edu”), it is university policy that it is your responsibility, not the responsibility of the university or the instructor, to arrange for email to be forwarded appropriately, i.e., it is your responsibility to make sure that you receive all email messages that are sent to your official email address.**

## Course topics (in approximate chronological order)

- Introduction to analytical chemistry and chemical analysis (week 1)
- Review of basic chemical measurements, units, and concentrations (week 1)
- Overview, general concepts, and principles of chemical equilibria (week 1)
- Solubility equilibria, gravimetric analysis, and combustion analysis (weeks 1 & 2)
- Introduction to titrations, titration curves, quantitative calculations, examples of titration reactions, endpoint detection, completeness of a titration reaction (weeks 2 & 3)
- Significant figures (brief review) and error propagation; statistical tests (Grubb's test, t-tests, and F-test); (week 3)
- Systematic treatment of chemical equilibria; monoprotic acid-base equilibria (week 3)
- Exam 1; monoprotic buffers; polyprotic acid-base equilibria (week 4)
- Ampholytes; amino acids; predominant charge state; fractional composition; acid-base titrations of polyprotic substances and/or mixtures; complexation equilibria and titrations (week 5)
- Introduction to electrochemistry; potentiometry and pH measurement; linear regression and calibration methods (week 6)
- Absorption and luminescence spectrophotometry (week 7)
- Mass spectrometry; extractions; xxxxxxxx (week 8)
- Introduction to chromatography; gas chromatography (week 9)
- High performance liquid chromatography (week 10)

## Academic Policies

Please review the following links provided below

- **Academic Misconduct, Cheating, Fabrication, Plagiarism, Withdrawal of a Degree**  
[http://www.drexel.edu/provost/policies/academic\\_dishonesty.asp](http://www.drexel.edu/provost/policies/academic_dishonesty.asp)

In Chem 230, if you are caught cheating on an exam, you will receive a score of zero (0) for that exam; this may pull your term average down so far that you receive a failing grade (F), depending on your performance on other exams, homework, etc.

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- **Course Drop Policy**  
[http://www.drexel.edu/provost/policies/course\\_drop.asp](http://www.drexel.edu/provost/policies/course_drop.asp)
- **Course Withdrawal Policy**  
[http://www.drexel.edu/provost/policies/pdf/course\\_withdrawal.pdf](http://www.drexel.edu/provost/policies/pdf/course_withdrawal.pdf)
- **Office of Disability Services**  
<http://www.drexel.edu/oed/disabilityResources/Overview/>

- **Course Change Policy**

The instructor may make changes to the course during the term at his discretion. If changes are made to the course, students will be notified via BbLearn, Sapling Learning (homework only) and/or email, and will be made aware verbally at the beginning of the next scheduled class.