Chemistry 220 - Fundamentals of Analytical Chemistry Lecture (Fall 2016)

Co-requisite: Chem 220L  Pre-requisites: Chem 112, 112L, Math 111 or equivalents

Instructor: Dr. Jay G. Forsythe  
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Office Hours: Wed 1:00 – 3:00 PM; Thurs 1:00 – 3:00 PM

Lecture Time and Location: Tues / Thurs, 9:25 – 10:40 AM, SSMB 127

Final Exam Time and Location: Thursday, December 8, 8:00 – 11:00 AM, SSMB 127

Student Learning Outcomes:

- To carry out concentration, titrimetric, equilibrium, and statistical calculations.
- To explain and apply the theory behind quantitative methods and modern instrumentation.
- To assess the quality of laboratory data and identify any sources of error.
- To construct and apply calibration curves used in chemical analysis.
- To explain the principle of chemical equilibria and its applications and perform appropriate calculations.
- To select the most appropriate method for a given chemical analysis.
- To demonstrate problem-solving abilities in the area of chemical analysis.

Attendance and Participation: Due to the math-heavy nature of this course, the majority of lecture material will not be on PowerPoint slides. Therefore, it is highly recommended you attend all lectures, and it is your responsibility to follow up on missed notes. While in class, it is expected that you will actively participate. Please refrain from texting, online games, social media, etc.

OAKS and E-mail: Major class announcements and handouts will be posted on the course OAKS webpage. Please check your CofC e-mail regularly for additional announcements and updates.

Required Materials:

- Exploring Chemical Analysis, 5th Edition, Daniel C. Harris (print or digital, either is fine)
- Sapling Online Homework (see page 3 for instructions)
- Scientific calculator with log and exponential functions

Disability Services: If you are a student with a documented disability who will require accommodations in this course, you must provide the proper documentation in the form of a Professor Notification Letter (PNL) by September 1. If you are certified to have extra time on tests and quizzes, this will need to be arranged with the SNAP office so that you can take it there. I will need the envelope for this test at least one week before the test so that I can have it delivered to the SNAP office in time for you to take it there. The same applies to the final exam. No exceptions.

Honor Code: Lying, cheating, attempted cheating, and plagiarism are violations of the Honor Code (http://studentaffairs.cofc.edu/honor-system/studenthandbook/index.php) and will be reported without exception. During exams, cell phones, laptop computers, and tablets must be put away. Graphing calculators are permitted on exams but storing material and/or notes on them will be considered cheating. Working together on homework is permitted in this course and is NOT considered cheating. However, you should use your best judgment to ensure collaborations are benefitting all individuals.
Course Evaluation: Course evaluations will be completed on the last day of class. I will leave the room early so you can fill out the electronic forms objectively.

Recommended Study Practices: Working problems is the best way to prepare for exams. In addition to assigned homework, I recommend looking at problems at the end of book chapters. Also, the Student Learning Center (SLC) is an excellent resource and has science-specific assistance (http://csl.cofc.edu/).

Course Outline:

Unit I:
• Chapters 1 and 2 (Measurements and Tools: skip section 1-5, skip sections 2-3 and 2-10)
• Chapters 3 and 4 thru section 4.5 (Math Toolkit and Statistics: skip section 4-6)
• Chapter 4 sections 4.6 - 4.7 and Chapter 5 (Calibration Curves)
• Chapter 6 (Titration: incorporate section 1-5 with 6-4; skip sections 6-5 and 6-6)
• Chapter 8 (Acids/Bases)

Unit II:
• Chapter 9 (Buffers)
• Chapter 10 (Acid and Base Titrations: skip derivatives in 10-4, skip section 10-6)
• Chapter 11 (Polyprotic Acids: skip amino acids in 11-1, skip proteins in 11-4)
• Chapter 12 (Equilibrium: skip problems using Debye-Huckel eqn in 12-2)

Unit III:
• Chapter 14 (Electrode Potentials)
• Chapter 15 (Electrode Measurements: skip section 15-5)
• Chapters 18 and 19 (Light and Spectrophotometry: skip sections 19-1 thru 19-3)
• Chapter 20 (Atomic Spectroscopy: skip section 20-2; skip sections 20-4 thru 20-6)

Unit IV:
• Chapter 21 (Chromatography: skip section 21-5)
• Chapter 22 (GC and LC: skip sections 22-2 and 22-4)

Expected Due Dates and Exam Dates:

Online homework and writing assignment due dates are subject to change. These assignments will be due at the beginning of class (9:25 AM) for the specified dates below. Test dates are unlikely to change, but the material covered may change depending on lecture pace.

Unit I:
• Ch 1-2 homework: due Tuesday, 8/30
• Ch 3-5 homework: due Tuesday, 9/6
• Writing 1: due Thursday, 9/8
• Ch 6/8 homework: due Tuesday, 9/13
• Exam 1: Tuesday, 9/13 at 9:25 AM (in class)

Unit II:
• Ch 9 homework: due Thursday, 9/22
• Ch 10 homework: due Thursday, 9/29
• Writing 2: due Tuesday, 10/4
• Ch 11 homework: due Thursday, 10/6
• Ch 12 homework: due Tuesday, 11/11
• Exam 2 (Midterm): Tuesday, 10/11 at 9:25 AM (in class)

Unit III:
• Ch 14 homework: due Tuesday, 10/25
• Ch 15 homework: due Tuesday, 11/1
• Writing 3: due Thursday, 11/3
• Ch 18/19 homework: due Thursday, 11/10
• Ch 20 homework: due Thursday, 11/17
• Exam 3: Thursday, 11/17 at 9:25 AM (in class)

Unit IV:
• Ch 21 / 22 homework: due 12/1
• Writing 4: due Thursday 12/8
• Exam 4 (Final): Thursday, 12/8 at 8:00 AM (SSMB 127)

Grading:

Final grades will be given based on the following scale (decimal places of 0.50 and greater round up).

- A (100 – 93%)
- A- (92 – 90%)
- B+ (89 – 87%)
- B (86 – 83%)
- B- (82 – 80%)
- C+ (79 – 77%)
- C (76 – 73%)
- C- (72 – 70%)
- D+ (69 – 67%)
- D (66 – 63%)
- D- (62 – 60%)
- F (below 60%)

Student performance in lecture will be evaluated by:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Writing</td>
<td>5%</td>
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<tr>
<td>Homework</td>
<td>10%</td>
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<tr>
<td>Exam 1</td>
<td>20%</td>
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<tr>
<td>Exam 2</td>
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<td>Exam 3</td>
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<tr>
<td>Exam 4</td>
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<td><strong>Total</strong></td>
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Sapling Online Homework:

Homework assignments for each unit will be accessible when that unit begins, but will be due on specific days (see Due Dates). Directions for signing up for Sapling are provided below:

1) Go to saplinglearning.com and click on the Higher Ed option for your country at the top right.
2) Log in with your existing account or click Create an Account.
   a) If you have a Facebook account, you can use it to quickly create a Sapling Learning account. Click Create my account through Facebook. You will be prompted to log into Facebook if you aren't already. Choose a username and password, and then click Link Account.
b) Otherwise, supply the requested information and click Create My Account. Check your email (and spam filter) for a message from Sapling Learning and click on the link provided in that email. If you don't get the email within 30 minutes, contact support@saplinglearning.com.

3) Look for the gray bar entitled Enroll in a new course.
4) Click on your subject to expand the menu.
5) Click on the term to expand the menu further (note that Semester 1 refers to the first course in a sequence and not necessarily the first term of the school year).
6) Once the menus are fully expanded, you'll see a link to a specific course. If this is indeed the course you'd like to register for, click the link. Otherwise, continue expanding the other menus until you locate the correct link and click it.
7) You may be asked to enter a Key code, which is not the same thing as an Access Card Code from a scratch-off card. The key code (if necessary) should have been provided to you by your instructor.
8) Enter your zip code and pay if necessary. Most courses require payment using a credit card, a PayPal account, or an Access Card Code (http://www2.saplinglearning.com/help/how-do-i-enter-code-my-scratch-card) from a scratch-off card purchased at your bookstore. In some cases, you may have additional options to enter the course for free for a certain number of days, to use your Sapling Learning credit, or to buy multiple items for a bulk discount.

When you return from paying, you will be enrolled in your course. If your credit card is not accepted, it may help to create a PayPal account, store your credit card info there, then use the PayPal option to pay for Sapling Learning. Once you have registered and enrolled, you can log in at any time to complete or review your homework assignments. If you have any problems, send an email to support@saplinglearning.com explaining your issue.

Writing Assignments:

Documents should be ≤ 1 page in length, single spaced (references can go over). These will be graded as follows:

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<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tr>
<td>Content / accuracy / clarity</td>
<td>80%</td>
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<tr>
<td>Grammar and spelling</td>
<td>10%</td>
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<tr>
<td>Citations</td>
<td>10%</td>
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</tbody>
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100%

(see http://library.williams.edu/citing/styles/acs.php)

**Assignment 1:** Find a news article in the popular press (newspaper, magazine, internet) that involves analytical or environmental chemistry. Do NOT use a technical journal.

1. Summarize the article in one paragraph.
2. Make three lists of terms and concepts:
   a. terms you understand well
   b. terms that you are reasonably sure about
   c. terms that you don't understand
3. Write a list of questions, technical or otherwise, that the article raises in your mind.
4. Critique the article by addressing the validity of the data/arguments that the other uses. Be sure to include a proper bibliographic citation of your article.

**Assignment 2:** Find an article in Chemical and Engineering News of interest to you that involves analytical or environmental chemistry (examples: a new innovation, a real-world problem to be solved, employment opportunities, or government regulations). Discuss why you selected the article.

1. Briefly summarize the article.
2. What new chemistry concepts did you learn or if you did not learn new chemistry what was reinforced for you?
3. Do you agree or disagree with any ascertainment made by the author and why?

Be sure to include a proper bibliographic citation of your article.
Assignment 3: Find an article in one of the following journals that describes a new chemical analysis: Analytical Chemistry, The Analyst, or Environmental Science and Technology that describes a chemical analysis.
1. Summarize the method employed and the results that were found.
2. Describe how well you understood the article (or not).
3. What would you do as an analytical chemist to improve the procedure?
Be sure to include a proper bibliographic citation of your article.

Assignment 4: You will be given a journal article to critique with additional instructions.