FUNDAMENTALS OF ANALYTICAL CHEMISTRY  
CHEM 220  
Spring 2022

Instructor:  
Dr. Katherine M. Mullaugh  
Office:  
SSMB 310  
Phone:  
843-953-6587  
Email:  
mullaughkm@cofc.edu

Class Meeting Time: TR, 9:25 – 10:40 am  
Class Meeting Place: SSMB 127

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

Required Materials:  
*Exploring Chemical Analysis, 5th edition, by Daniel C. Harris*  
Scientific calculator with logarithmic and exponential functions


Why study analytical chemistry?  
Knowing the fundamentals of analytical chemistry prepares you to be a better scientist and citizen, regardless of your career path. Chemical analysis provides critical information about medicine, health, food, and the environment, and the skills you obtain in this course are highly relevant to a variety of different fields. Future chemists and biochemists will routinely use the tools of analytical chemistry in their career paths. Non-chemists can advance their own fields by recognizing the possibilities of analytical chemistry.

Student Learning Outcomes:  
By the end of the course, you will be able to...  
- To carry out concentration, titrimetric, equilibrium, and statistical calculations.  
- To explain and apply the theory behind quantitative methods and modern instrumentation.  
- To construct and apply calibration curves used in chemical analysis.  
- To assess the quality of laboratory data and identify any sources of error.  
- To select the most appropriate method for a given chemical analysis.  
- To explain the principles of equilibrium and its applications.  
- To demonstrate problem-solving abilities in the area of chemical analysis.

OAKS: I will post class material such as handouts, supplemental videos, recommended practice problems from the book and other class materials on OAKS.

Communication: From time to time I may communicate with the class via email. It is your responsibility to check your g.cofc.edu email account daily.

Student hours: My regularly scheduled office hours listed on the right are “open door” times when I will be in my office if you have a question or need help. If you are unable to make it to the listed office hours, email me with two or three suggested times and we will set up a meeting that works with both our schedules. I am also happy to schedule appointments with students over Zoom.

<table>
<thead>
<tr>
<th>Student hours (SSMB 310 or Zoom)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Day</strong></td>
<td><strong>Time</strong></td>
</tr>
<tr>
<td>Monday</td>
<td>10 am – 11 am</td>
</tr>
<tr>
<td>Wednesday</td>
<td>12 pm – 1 pm</td>
</tr>
<tr>
<td>Thursday</td>
<td>2 pm – 3 pm</td>
</tr>
<tr>
<td>Friday</td>
<td>11 am – 12 pm</td>
</tr>
</tbody>
</table>
Attendance Policy: As this is an in-person class, it is expected you will attend all classes in person. If you must miss a class for any reason, including quarantine and isolation for COVID-19, please let me know in advance so I will know to set up Zoom for you that day. However, my attention will primarily be focused on the students in the room and students viewing class online are bound to have a sub-par experience. Therefore, Zoom should not be relied upon as a routine substitute for lecture. Lectures will not be recorded unless extenuating circumstances exist. If you must attend class remotely on a day we have a quiz (Tuesdays), you will take your quiz at the same time as the other students and submit it electronically, assuming you are well enough to do so.

Classroom Conduct: I expect you to behave as professional adults in this class. Please do not disrupt class by talking while the professor is lecturing or another student is speaking. Be on time for class and try to only leave class when necessary. Please refrain from using electronic devices during class for activities not related to lecture. It is required that you adhere to CofC’s COVID-19 safety protocols by wearing a mask and you are strongly encouraged to wear a high quality (N95 or equivalent strongly encouraged) mask. Please refrain from eating and minimize drinking so that you can stay masked throughout class.

Lecture videos: To allow more class time for active learning and assessments (described below), I have several pre-recorded videos for each class period. The videos are typically short (~10 minutes each) and should be viewed before class (typically 2 – 3 videos per class period). You should pay full attention and take notes, just like in a traditional face-to-face lecture.

Active Learning: Active learning exercises will be used throughout the semester in nearly every class period, either individually or in small groups. A large body of educational research shows that students learn more and perform better when they are actively engaged, rather than passively listening, in class. This is especially true when students work in groups because of the opportunity to learn from each other, rather than just from the instructor. Working with other people is also a key skill for almost every professional occupation, so a complete education should include practice at this skill. Finally, when you work in groups, it makes your thinking clear to me. If I talk and you listen, there aren’t many opportunities for me to learn how things are going. When I hear you discussing ideas in class each day, it gives me important feedback about which topics we have mastered and which need to be revisited. You cannot participate in active learning if you are not present.

Homework: Recommended book problems are provided to gain further practice. These problems are usually not collected or graded, but a student who does not make time to solve problems independently will not be sufficiently prepared for tests. Most answers to end of chapter problems are given in the back of the book (p. 591 – 600). Detailed solutions can be found in the solution manual (recommended), which is available in the bookstore or online.

Specifications grading system: Extensive use of partial credit in points-based grading can make it difficult to tell what a student has actually learned, and letter grades do not always provide to meaningful representations of actual learning. Besides, you can learn best when you can focus on the material rather than obsessing over points. For this reason, I have adopted a more transparent grading system called specifications grading in which your grade will be based on the number of clearly articulated learning outcomes (specifications) that you are able to demonstrate mastery on using regular, low stakes assessments (quizzes) in class. By decreasing our reliance on high stakes tests and recentering our attention on the course content, my hope is that we can better manage any anxiety you may have about grades and help you see a clear path to being successful in this course.
I have broken the course content up into 13 weekly modules. Quizzes will be offered weekly at the start of every Tuesday class to assess your grasp of the theory and application of course content covered during the previous week. You can find the list of the 13 modules on OAKS. Each module has a primary focus that is split into 3 – 5 clearly stated learning outcomes so as you prepare for a quiz, you will know what exactly you are studying for. Rather than getting a traditional grade on quizzes with partial credit arbitrarily assigned, your work will assessed as being at one of three levels, described in the table below.

<table>
<thead>
<tr>
<th>Letter</th>
<th>Stands for</th>
<th>What this means</th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>Mastery</td>
<td>You have mastered the material and have demonstrated you understand it to significant depth and can reliably apply that understanding to solving problems, including those that require the synthesis of various ideas. Mastery is consistent with typical “A” work.</td>
</tr>
<tr>
<td>D</td>
<td>Developing</td>
<td>You are competent with some material, but some gaps still exist. You can apply your understanding to straightforward problems, but struggle when asked to solve problems that require the synthesis of various ideas. Items falling in this category would be consistent with B/C work.</td>
</tr>
<tr>
<td>U</td>
<td>Unsatisfactory</td>
<td>You lack command over the material and are unable to solve problems that are deemed straightforward. This also applies if you do not attempt one or more questions on a quiz. Any assessment earning a “U” would likely earn a D or F if scored normally.</td>
</tr>
</tbody>
</table>

Because learning is an iterative process, it’s understandable that you likely will not immediately demonstrate mastery with every quiz. Therefore, there will be a system in place for you to earn opportunities to retake an assessment for a module. You can have a maximum of one retake in a given week. You can retake a module’s corresponding quiz up to two times, and you will need to do more outside of class to earn the opportunity to retake a quiz you initially earned a grade of “unsatisfactory.”

**How do I earn retakes?**

One of the goals of specifications grading is to encourage you to take ownership over your learning. If you get feedback on a quiz that you have some (“developing”) or significant (“unsatisfactory”) gaps in your understanding, you are required to go back to try to learn the material better before trying again. Evidence of your active learning outside of class will be submitted to me to earn a retake. Some possible forms would be:

- Doing book problems related to a module.
- Writing out a detailed revision of the original quiz with correct answers and clear explanations of every step.
- Rewatching posted video lectures and taking detailed notes.
- Preparing a study guide for the module.

If you are seeking to retake a quiz you initially earned “developing” on, you just need to do one of the above items. If you are seeking to retake a quiz you initially earned “unsatisfactory” on, you will need to submit two of the above items. Each module will have an associated dropbox on OAKS for students to submit material to. I will try to review it within 24 hours (or by Monday if submitted over the weekend) and if it is deemed sufficient, will contact you to schedule a retake. **Scheduling retakes is one of the most logistically challenging aspects of this approach so I appreciate as much flexibility as possible.**
How might I lose the opportunity for a retake?
You can also forfeit your eligibility to retake a quiz for a particular module. The following are actions that would exclude you from earning a retake:

- Skipping class with no communication with the instructor (see attendance policy)
- Not watching all posted videos on OAKS (e.g., not accessing video at all or accessing them for a period of time shorter than the video length) by the time that module’s original quiz was taken
- Not participating in active learning during class
- Being disrespectful to your instructor or classmates (see classroom conduct policy)

Final letter grades
The table below represents the final letter grades associated with the number of modules fully or partially mastered.

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>A-</th>
<th>B+</th>
<th>B-</th>
<th>C+</th>
<th>C-</th>
<th>D+</th>
<th>D-</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mastered</td>
<td>≥12</td>
<td>11</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Developing</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>11</td>
<td>≥12</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Final Exam: The final exam is cumulative and will be **Saturday, April 30 10:30 am – 12:30 pm**. Future details on exactly how the final exam will factor into your final letter grade will be shared closer to the time of the final. This will be an ACS test so you must be prepared to take it with a scientific (not graphing) calculator

Other Important Dates:
- Tuesday, January 11: Last day for add/drop
- Friday, March 25: Last day to withdraw with a grade of “W”
- Tuesday, April 26: Reading Day
- Saturday, April 30, 10:30 am – 12:30 pm: Final Exam

Academic Integrity Statement (3.12):
Lying, cheating, attempted cheating, and plagiarism are violations of our Honor Code that, when suspected, are investigated. Each incident will be examined to determine the degree of deception involved.

Incidents where the instructor determines the student’s actions are related more to misunderstanding and confusion will be handled by the instructor. The instructor designs an intervention or assigns a grade reduction to help prevent the student from repeating the error. The response is recorded on a form and signed both by the instructor and the student. It is forwarded to the Office of the Dean of Students and placed in the student’s file.

Cases of suspected academic dishonesty will be reported directly by the instructor and/or others having knowledge of the incident to the Dean of Students. A student found responsible by the Honor Board for academic dishonesty will receive a XXF in the course, indicating failure of the course due to academic dishonesty. This status indicator will appear on the student’s transcript for two years after which the student may petition for the XX to be expunged. The F is permanent.

Students can find the complete Honor Code and all related processes in the Student Handbook at: [http://deanofstudents.cofc.edu/honor-system/studenthandbook/](http://deanofstudents.cofc.edu/honor-system/studenthandbook/)“
Accommodations for Students with Disabilities
The College will make reasonable accommodations for persons with documented disabilities. Students should apply for services at the Center for Disability Services/SNAP located on the first floor of the Lightsey Center, Suite 104. Students approved for accommodations are responsible for notifying me as soon as possible and for contacting me one week before accommodation is needed.

Inclement Weather, Pandemic or Substantial Interruption of Instruction (3.8)
If in-person classes are suspended, faculty will announce to their students a detailed plan for a change in modality to ensure the continuity of learning. All students must have access to a computer equipped with a web camera, microphone, and Internet access. Resources are available to provide students with these essential tools.

Mental & Physical Wellbeing:
At the college, we take every students’ mental and physical wellbeing seriously. If you find yourself experiencing physical illnesses, please reach out to student health services (843.953.5520). And if you find yourself experiencing any mental health challenges (for example, anxiety, depression, stressful life events, sleep deprivation, and/or loneliness/homesickness) please consider contacting either the Counseling Center (professional counselors at http://counseling.cofc.edu or 843.953.5640 3rd Robert Scott Small Building) or the Students 4 Support (certified volunteers through texting "4support" to 839863, visit http://counseling.cofc.edu/cct/index.php, or meet with them in person 3rd Floor Stern Center). These services are there for you to help you cope with difficulties you may be experiencing and to maintain optimal physical and mental health.

Food & Housing Resources:
Many CofC students report experiencing food and housing insecurity. If you are facing challenges in securing food (such as not being able to afford groceries or get sufficient food to eat every day) and housing (such as lacking a safe and stable place to live), please contact the Dean of Students for support (http://studentaffairs.cofc.edu/about/salt.php). Also, you can go to http://studentaffairs.cofc.edu/student-food-housing-insecurity/index.php to learn about food and housing assistance that is available to you. In addition, there are several resources on and off campus to help. You can visit the Cougar Pantry in the Stern Center (2nd floor), a student-run food pantry that provides dry-goods and hygiene products at no charge to any student in need. Please also consider reaching out to Professor ABC if you are comfortable in doing so.

Inclusion:
The College of Charleston offers many resources for LGBTQ+ students, faculty and staff along with their allies.

- Preferred Name and Pronoun Information
- On Campus Gender Inclusive facilities
- Campus Resources
- College of Charleston Reporting Portals
- National Resources for Faculty & Staff
- GSEC Reports
- Documenting LGBTQ Life in the Lowcountry (CofC Addlestone Library Special Collections Project)
- College of Charleston Quality Enhancement Plan (QEP)
- Articles about CofC and LGBTQ+ Issues