

Instructor: Dr. Greg Pillar

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Office Hours: T-TH, 8:30-11am and W 4:05 – 5:00 pm; anytime my door is open; by appointment

Textbook: *Quantitative Chemical Analysis*, by D.C. Harris, 7th edition, W.H. Freeman

Course Introduction: Welcome to CHEM 305! This course provides an introduction to the theory and practice of quantitative analytical chemistry. We will discuss how various qualities of molecules (i.e. acid base reactivity or the ability to absorb light) can be used in the identification, quantitation, or separation of specific compounds. Topics will include volumetric analysis, spectroscopy, electrochemistry, acid-base chemistry, redox reactions, and chromatography. In the lab component of this course you will explore various analytical techniques such as volumetric titrations, spectroscopy, and chromatography to reinforce concepts covered in class.

Course Objectives: By the end of this course students should:

- Be able to perform accurate chemical calculations
- Use statistical methods to analyze the precision of replicate measurements
- Calculate the pH of *any* acid or base solution
- Calibrate analytical procedures using known standards
- Be able to separate and identify unknown compounds using chromatography

Course Requirements/Grading:

Problem Sets/Quizzes	200
Proposal	150
Exams (3 lecture)	450
Final Exam	200

Total: 1000 points

Grading Scale:

A	93 (930)	C+	77 (770)
A-	90 (900)	C	73 (730)
B+	87 (870)	C-	70 (700)
B	83 (830)	D	60 (600)
B-	80 (800)	F	<60 (< 600)

Attendance Policy: Students are expected to attend all classes and are responsible for daily assignments. It is well known and documented that students who attend class learn more than those who do not. You are allowed to miss two class sessions over the semester with no penalty. For each additional absence, *two* points will be deducted from your final point total. If you miss a class to participate in a Queens-related activity, you will still be counted absent, however, you may make up this loss of participation by submitting a one page write-up of a chemistry related topic chosen by me.

Participation = attendance, speaking during discussion, being on time, and paying attention during class.

Late Work: Late assignments and papers are subject to a 5% grade reduction per weekday with a 25% maximum (i.e. five days' worth).

Quizzes, Exams, and the Final Exam: Quizzes will consist of multiple-choice and short answer questions covering course material and readings for that week. Quizzes or in class assignments may not be made up. Students are allowed to miss one quiz/in class assignment without penalty (i.e. lowest quiz score will be dropped). All exams (except the final exam) will consist of multiple choice, short answer, and essay questions. Exams will include material covered since the previous exam. The final exam will also consist of multiple choice, short answer, and essay questions.

If you miss an exam, your grade will be a zero. There are no make-up exams. However, your final exam score can be used to replace your lowest lecture exam score.

Exam Review Sessions: Review sessions will be offered one or two days before each exam. The review sessions will be held in the evening at a time and place to be determined. The purpose of the review sessions are to provide students with additional opportunities to ask questions and review course material. I may or may not prepare material to cover and will rely mostly on questions posed by the students.

Research Proposal: This will be a proposal for an original research project, to be carried out during the following spring semester. Those students taking CHEM 307 will be expected to complete this project for that course. The research proposal is worth 10% of your course grade and has the following deadlines:

Topic Due:	Monday, September 24 th
Draft Due (3 copies):	Monday, November 12 th
Final Copy Due:	Friday, November 30 th

Open Door Policy: If you have any questions, problems or concerns related to this class or anything else, please feel free to stop by my office at anytime. I am here to help you understand the course material and to assist you through your studies. Review/study sessions are available on a one on one basis or in a group setting for material covered in either lecture or lab.

Other Policies: Please be considerate of your fellow students and instructor. Please do not eat during class (drinks are okay in lecture). Please turn off all cell phones, pagers, or other communication devices. If you need to have your cell phone on please keep it on vibrate and notify me before class starts. Students are expected to arrive on time and stay in class until the period ends. Please avoid disrupting the class if you arrive late or need to leave early.

Course Schedule: **tentative**

Chapter 0	The Analytical Process	
Chapter 1	Measurements	
Chapter 2	Tools of the Trade	
Chapter 3	Experimental Error	
Chapter 4	Statistics	
Chapter 5	Calibration Methods	Exam #1 – Week of September 10th
Chapter 6	Chemical Equilibrium	
Chapter 7	Volumetric Analysis	
Chapter 8	Activity	
Chapter 9	Monoprotic Acid-Base Equilibria	
Chapter 10	Polyprotic Acid-Base Equilibria	Exam #2 – Week of October 8th
Chapter 11	Acid-Base Titrations	
Chapter 12	EDTA Titrations	
Chapter 14	Fundamentals of Electrochemistry	
Chapter 15	Electrodes and Potentiometry	
Chapter 16	Redox Reactions	Exam #3 – Week of November 5th
Chapter 23	Introductions to Analytical Separations	
Chapter 25	Liquid Chromatography	
Chapter 24	Gas Chromatography	

Lab Schedule: **tentative**

1. Precision Exercise: Acetic Acid in Vinegar
2. Standardization of a Base; Acid Unknown
3. Standardization of an Acid; Base Unknown
4. Determination of water hardness
5. Gravimetric Determination of Calcium
6. Spectrophotometric Determination of Manganese in Steel
7. Visual MINTEQ
8. Introduction to Electrochemistry and Voltaic Cells
9. HPLC identification of RDX/HMX/TNT

STUDY HINTS AND ADVICE:

1. **Read the text before coming to class.** This course will begin slow but then proceed on a fast pace throughout the whole semester. No matter how clear the lecture may seem, if it is your first encounter with the material, you will probably not retain much of the content of the lecture. On the other hand, if you have read the course material in advance, at your own pace, the lecture will make a lot more sense and it will improve your understanding.
2. **Work problems religiously and independently.** You won't be able to grasp a concept or theory completely and correctly unless you try to solve the problems by yourself. It is extremely important to do the homework problems after each class. Mistakes at this point can be very helpful and easily fixed. Try several approaches. If you need to look at the answer, come back later to the same problem without looking it up. When working problems on a multiple choice test, it is often useful to eliminate answers you know are wrong. Even if you don't know which of five answers is the right one, if you eliminate three incorrect answers your odds of choosing the correct answer are improved considerably.
3. **Form or join a study group.** Working together with other students is one of the most effective ways to study chemistry. You can often get immediate help from your study partners on difficult concept, and helping other people is an excellent way to make sure that you have a good understanding of the material. It's often more useful to explain to someone else how to work a problem than it is to work it yourself.
4. **Re-write your lecture notes.** Often times you may be rushed during class to get all the notes down and you may abbreviate or not have time to write everything out. Re-writing your notes (especially that same day) will help you to fill in blanks and missed pieces of information that you didn't have time to jot down. Additionally, re-writing your notes forces you to re-read what you wrote and will help you understand and learn the material. It also provides repetitive exposure to class material.
5. **Ask questions!!** There are no stupid questions. Chances are if you are confused or unsure about something, someone else is as well. Don't be afraid to ask questions at anytime. Additionally, don't be afraid to stop by my office to ask questions. I am here to help you throughout your studies.
6. **Attend review sessions.** Even if you feel you understand the course material, review sessions provide an opportunity (similarly with study groups) to reinforce the course material. If you do have questions, it provides yet another opportunity for you to ask your instructor additional questions.
7. **START STUDYING FOR EXAMS EARLY.** Avoid waiting to the last minute to study. If you "cram" you may be ok for the exam but you will probably not remember the material for the final exam or after that. Start studying roughly a week before the exam and study in short time segments.