



Chemistry 332W
Analytical Chemistry
Dr. Jeremy Ramsey
Fall 2008



Course Description

The material presented in this course covers the basic principles of analytical chemistry, including calibration methods, measurement statistics, equilibrium, acid-base chemistry, and buffer systems. Additionally, the course will cover an introduction to the major areas of chemical analysis and instrumentation (spectroscopy, separations, and electrochemistry).

This course will likely be different from the other courses that you will take in the Lycoming Chemistry department. The material lends itself nicely to a more active method of learning. By active, I mean that you will be doing instead of watching. We will spend a significant amount of time working problems and discussing the material as opposed to the traditional lecture format. In fact, there will be very few class periods where I will lecture for the entire class period.

Chemistry 332 is also a writing intensive course and will count toward your writing across the curriculum requirements. The assignments will include a minimum of 10 pages of formal writing (formal research manuscript, instructions) and 15 pages of informal writing (notebook entries, laboratory reports).

Philosophy of Instruction

Ultimately, the purpose of this course is for you to learn the fundamentals of analytical chemistry and to be exposed to the foundations of modern instrumental analysis. In my opinion, grades are secondary to your understanding of the subject, and ideally, I am willing to present each of you with an A. However, my goal is not to help students achieve a certain grade in this course, but rather, is to ensure that students achieve mastery of the subject. By choosing to come to Lycoming, I have dedicated myself to helping each student achieve this goal. The motivation, however, must begin with you. Please take advantage of the opportunities that you have and we will both achieve our goals for the semester.

Learning Objectives

Upon completion of this course, students should be able to

- Perform calculations involving stoichiometry and solution concentration as they relate to laboratory problems
- Use common laboratory tools such as volumetric flasks, pipets, burets, pH meters, and balances
- Perform calculations involving chemical equilibria (i.e. solubility, acid-base chemistry) and understand how the calculated parameters relate to the chemistry of the system
- Understand the fundamental principles of spectroscopy, separation science, and electrochemistry and how they relate to chemical analysis
- Use the conclusion of statistical analysis to determine sources of experimental error and to direct the path of subsequent chemical experimentation
- Communicate scientific data clearly in written and oral presentations
- Use graphical analysis software to analyze data and prepare publishable quality graphs

Prerequisites

- Chemistry 111 or permission of instructor
- Knowledge of chemical reaction stoichiometry and equilibrium (Quiz on Friday 9/29).

Meeting Times

Lecture	MWF	10:15-11:05 am	215 Heim
Laboratory	T	1:00-3:50 pm	207 Heim
	Th	2:00-4:50 pm	207 Heim

Required Course Materials

- Quantitative Chemical Analysis, 7th edition, Daniel Harris
- Bound laboratory notebook
- Safety Glasses
- Calculator capable of performing logarithmic, exponential, and statistical functions. If you have a programmable TI, be sure to bring it along for the ride—it will get a lot of use.

Moodle

This course utilizes a content management system (fancy name for a website) called Moodle. Material will be posted on this site and no announcement will be made so you will be **expected** to check this website frequently. The web address for the site is

<http://moodle.lycoming.edu/moodle/course/view.php?id=502>

Office Hours

I like a more open format for office hours. If you have questions, stop by when you have time. I do tend to be busy (especially as I teach General Chemistry during the same semester as this course); so if you like, you can always make an appointment. I really like to spend time with my students (and it can get lonely sitting alone in my office), so feel free to drop by anytime to chat. My door is (almost) always open.

Safety

Safe laboratory practices, including proper attire, will be expected at all times. Long pants are required as well as closed toe shoes (no sandals). Wearing contact lenses during laboratory session is strongly discouraged, but may be tolerated with prior approval. You will not be permitted to begin any experimental procedures until all safety concerns have been addressed. ***Repeated or severe safety violations may cause you to be removed from the laboratory, a zero to be awarded for the current experiment, and/or a zero to be awarded for the cleanup and safety portion of your grade.***

Grading

	<u>Points</u>
Examinations (4) and Quizzes	500
<i>Highest midterm exam score</i>	120
<i>Middle midterm exam score</i>	110
<i>Lowest midterm exam score</i>	100
<i>Final exam</i>	120
<i>Quizzes</i>	50
Laboratory	250
<i>Bootcamp Reports</i>	50
<i>Mini-Project Report</i>	50
<i>Project Final Report</i>	85
<i>Presentations</i>	50
<i>Cleanup and Safety</i>	15
Colloquium Attendance	25
Total Points	<u>775</u>

- Percentage grades will be scaled to the number of points indicated above.
- The grading scale will be as follows. Adjustments to this scale are possible, but unlikely.

≥ 90%	A range (A/A- cutoff: 92%)
80-89%	B range (B+/B cutoff: 88%, B/B- cutoff: 82%)
70-79%	C range (C+/C cutoff: 78%, C/C- cutoff: 72%)
60-69%	D range (D+/D cutoff: 68%, D/D- cutoff: 62%)
< 60%	Fail

- ***You must achieve at least 60% of the points in each portion of this course (lecture and laboratory) to earn a passing grade in this course.***
- There will be no makeup examinations or quizzes. One exam absence (for instance, an illness or a funeral) can be replaced by the average exam score for the semester only if the reason for the absence is approved by the Provost's office and the instructor is notified in advance. ***Otherwise, you will be awarded a zero for missed exams.*** There is no provision for missed quizzes—they result in a zero.
- Makeup laboratory experiments will be difficult, if not impossible, and will only be permitted for legitimate reasons.
- Cell phones use in class is not acceptable and will not be tolerated. They should be placed in your backpack and the ringer should be turned off.
- You will be required to attend a minimum of 5 colloquia (5 points each). If you have a college sanctioned activity that prevents you from attending, please see me to discuss an alternative.
- The cleanup/safety portion of your grade will be awarded based on the cleanliness of the laboratory (and especially the balances) as well as your safe laboratory practices.

Quizzes

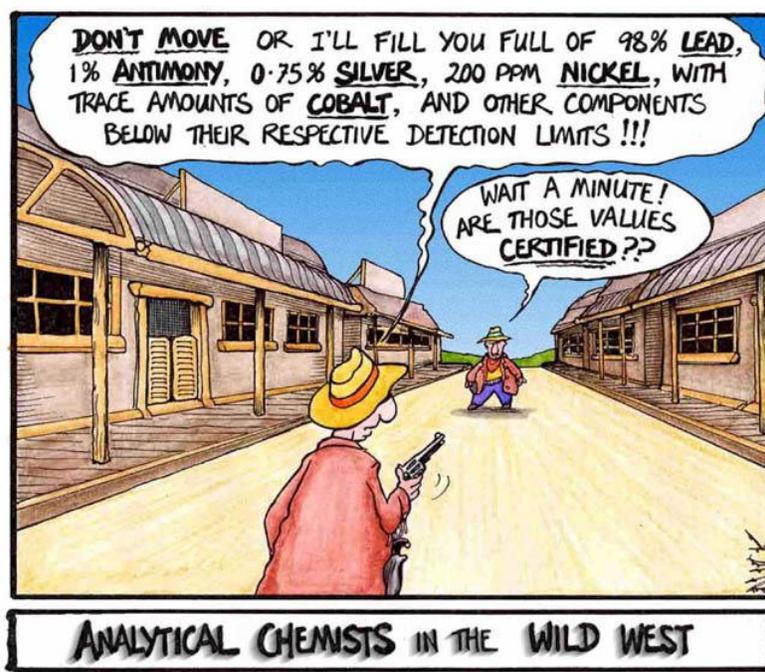
Although they will normally be announced, quizzes may be **unannounced** and can be given in either laboratory or lecture class periods. The purpose of these quizzes is to provide you with an opportunity to determine where your deficiencies may be and to provide a “gentle” reminder of how important it is to stay current with the progress of the course. As with the examinations, quizzes should be considered cumulative and may contain information from the laboratory or lecture portion of the course.

Lab Reports

Lab reports and data sheets are due one week (7 days) following completion of the experiment, unless otherwise informed by the instructor. Grades on late lab reports will be reduced by 25% plus 5% per calendar day beyond the due date. The format of the reports will be covered prior to the first, active laboratory period. Reports will be collected via Moodle. *No handwritten reports will be accepted.*

Homework

In this course, homework assignments will not be collected, but it is strongly suggested that you attempt them. The selected homework problems provide an indication of the topics that I think are important. This makes solving them of utmost importance to your grade and your performance in the course will likely correlate with the amount of time spent solving problems. Answers can be checked with the solutions manual (a copy will be on reserve in the library). Because learning has been shown to be much more efficient through failure, I feel strongly that should be attempted individually without seeking help from others or checking the answer in the solutions manual. Please feel free to stop by my office to discuss any difficulties you may have with any of the suggested problems.



Examinations

Examinations will be given on Thursday's during laboratory sessions and will be administered on the following dates. Because the material presented later in the class builds upon concepts presented earlier, all exams should be considered cumulative. Changes to the exam schedule will be made only with unanimous consent of the class and must be made prior to August 29th.

Examination 1	September 25
Examination 2	October 23
Examination 3	November 20
Final Examination	December 8

** The final examination time and date is established by the registrar. It cannot be changed.

Attendance

Attendance in class is very important to your success in this course. Although no unexcused absences from either lecture or lab will be tolerated (even on days of exams in other courses), up to three excused absences will be permitted without affecting your grade. The excuse must be legitimate and you may be required to receive approval from the Provost's office for the absence. Violations of the attendance policy will result in a 5% reduction in your final grade.

There will be no makeup examinations or quizzes. One exam absence (for instance, an illness or a funeral) can be replaced by the average exam score for the semester only if the reason for the absence is approved by the Provost's office and the instructor is notified in advance. Otherwise, you will be awarded a zero for missed exams. There is no provision for missed quizzes—they result in a zero.

Writing/Laboratory Project

I am in the process of revamping the writing projects for this course in an effort to teach you more about the analytical process and how it is reported. In the process, there will actually be less writing for this semester than in semesters past. However, the writing that you do submit will be more heavily evaluated and directed toward the writing that you will realistically have to do as a chemists/scientist. The semester-long assignment will involve choosing a laboratory experiment (from a list of pre-approved experiments), performing the experimental project (with a partner), and reporting the results in a manuscript format (individually; *Analytical Chemistry* style). You will be given enough laboratory time to prove that the experiment does work and to analyze an unknown sample. The culmination will be a manuscript that describes the procedure used, the results achieved, and the errors observed. Success in this project will involve skills in both laboratory and writing techniques.

A draft of the manuscript components will be submitted (in parts) and will be reviewed by a fellow student and myself. This is meant to simulate the process used for the submittal of a manuscript to a professional journal. Using the reviewer comments, you will revise the individual components and combine them into a manuscript prior to submitting it for a final project grade. As always, I will be available to help you with any portion of this project. You should seriously consider beginning the library research NOW! Late assignments will be penalized 25% plus 5% from each day past the due date. The schedule of due dates is listed later in this syllabus. Turnitin.com may be utilized to prevent plagiarism for all writing assignments.

Laboratory Topic Schedule

The laboratory schedule presented here is tentative and can change during the semester.

Week Beginning (Monday)	Laboratory Topic
August 25	Writing Workshop Excel/Igor Workshop
September 1	Glassware Calibration
September 8	Statistics
September 15	Instrument Calibration <i>Technique Presentations</i>
September 22	NaOH Standardization Exam 1
September 29	Intro to Spectroscopy
October 6	Mini-project
October 13	Mini-Project
October 20	Mini-Project Exam 2
October 27	Lab Project
November 6	Lab Project
November 13	Lab Project
November 20	Lab Project Exam 3
November 27	Thanksgiving Break
December 1	<i>Lab Project Presentations</i> Check Out
December 8	Final Exam Week

Laboratory Experiments for Fall 2008

While Results and Sample Calculations will be due for each experiment completed, only portions of lab reports will normally be due.

Introduction to Microsoft Excel for Data Analysis: How much copper is in a penny?

Introduction to Calibration: Volumetric delivery using laboratory glassware and instruments

Introduction to Statistics: How much zinc is used to galvanize outdoor nails?

Introduction to Calibration: Measurements using a pH electrode and meter

Introduction to Titration: Preparation and standardization of a sodium hydroxide solution

Introduction to Ultraviolet/Visible Spectroscopy: Determination of the concentration of food dyes in Kool Aid

Mini-Project: Analysis of an impure industrial product

Approved Laboratory Projects for Chemistry 332W-- Fall 2008

Back-Titration for the Analysis of Antacids

Determination of Vitamin C in Fresh Fruit Juices

Olfactory Detection of Titration Endpoints

Spectroscopic Detection of Titration Endpoints

Determination of the Sodium Content of Potato Chips

Determination of Zinc in Cold Lozenges

Determination of the Copper Content of a Penny

Determination of the Caffeine and Benzoic Acid Content of Soda

Determination of the Calcium Content of an Eggshell

Determination of the Effectiveness of Water Filters at Removing Ionic Species

Determination of the Manganese Content of Steel

Determination of the Iron Content of Vegetables

Determination of Formaldehyde Released in Cigarette Smoke

Use of Natural Product Extracts as pH Indicators

Determination of Sulfite in White Wine

Titrimetric Determination of Carbon Dioxide Released from Chemical Reaction (i.e. Pop Rocks)

Laboratory Project Assignment Schedule

<u>Date</u>	<u>Assignment</u>
September 1	Project Selection Due
September 29	Project Procedure Due
October 6	Project Procedure Review Due
October 17	Introduction Draft Due
October 27	Revised Procedure Due
December 8	Final Project Report Due