

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, separation science, and electrochemistry).

This course will likely be different from the other courses that you have taken. 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 would be 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) properly
- 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

"In the middle of difficulty lies opportunity"

-- Albert Einstein

"The best way to learn and get better is to screw up and not do it again."

-- Greg Maddux

"In order to succeed, your desire for success should be greater than your fear of failure."

-- Bill Cosby

Prerequisites

- Chemistry 111 or permission of instructor
- Knowledge of chemical reaction stoichiometry and equilibrium (Quiz on Friday 10/04).

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=732>

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 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. Multiple expulsions from the laboratory will cause students to receive zero credit for the laboratory, which will cause failure of the course.**

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 (ACS Standardized)</i>	120
Quizzes	50
Laboratory	260
<i>Bootcamp Reports</i>	40
<i>Mini-Project Report</i>	50
<i>Project Final Report</i>	75
<i>Presentations</i>	75
<i>Cleanup and Safety</i>	20
Colloquium Attendance	15
Total Points	775

- 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 (3 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.

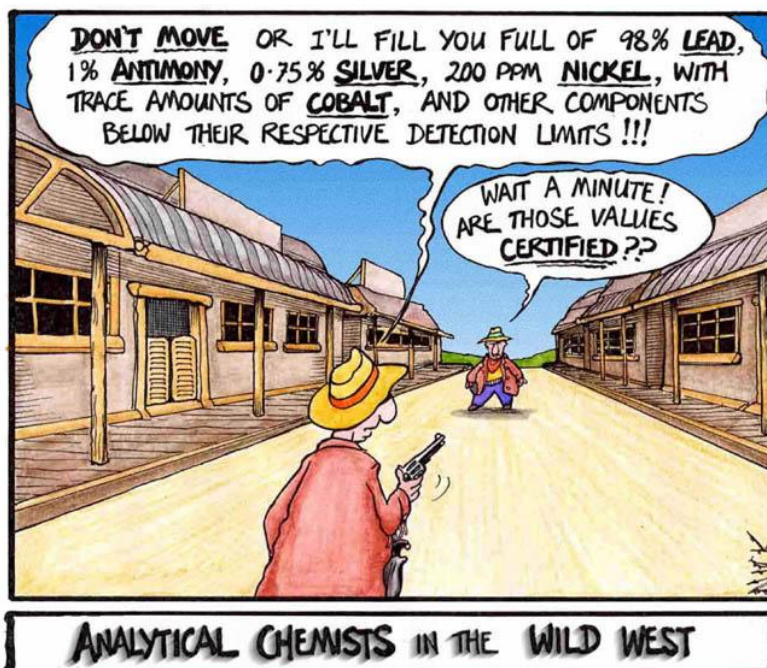
Attendance

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 10% reduction in your final grade. In the case of a campus-wide flu outbreak, Lycoming College advises that you do not attend class until any fever has dissipated for 24 hours. I will honor this policy, so *if you find that you have contracted the flu*, you should contact Dr. Ramsey or your lab instructor using your Lycoming email prior to missing your first class.

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.

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. 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.



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.

Examinations

Examinations will be given 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 September 4th.

Examination 1	October 6 (Tuesday)
Examination 2	November 3 (Tuesday)
Examination 3	December 3 (Thursday)
Final Examination **	December 15 (Tuesday Morning)

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

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.*

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 any or 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 31	Excel/Igor Workshop
September 7	Accuracy and Precision Accuracy and Precision
September 14	Popcorn Statistics
September 21	<i>Project Presentations</i> Instrument Calibration
September 28	Soda Titration/Spectroscopy Soda Titration/Spectroscopy
October 5	Soda Titration/Spectroscopy Exam 1
October 12	Mini-project
October 19	Mini-Project <i>Bootcamp Presentations</i>
October 26	Mini-Project
November 2	Lab Project Exam 2
November 9	Lab Project
November 16	Lab Project
November 23	Lab Project
November 30	Lab Project Exam 3
December 7	<i>Lab Project Presentations</i> Check Out
December 14	Final Exam Week

Bootcamp Laboratory Experiments for Fall 2009

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

1. Introduction to Microsoft Excel/Igor Pro for Data Analysis: How much copper is in a penny?
2. Introduction to Measurements and Uncertainty: Which method is most precise and accurate?
3. Introduction to Statistics: How much water is in a kernel of popcorn?
4. Introduction to Calibration: Measurements using a pH electrode and meter
5. Introduction to Titration: Determination of carbon dioxide in soda
6. Introduction to Ultraviolet/Visible Spectroscopy: Determination of phosphoric acid in soda
7. Mini-Project: Analysis of an impure industrial product

Approved Laboratory Projects for Chemistry 332W-- Fall 2009

Back-Titration for the Analysis of Antacids
 Olfactory of Scent Detection of Titration Endpoints
 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
 Use of Natural Product Extracts as pH Indicators
 Determination of the Protein Albumin in Egg White
 Determination of Sulfate in Seawater
 Determination of the Amount of Aspartame in Artificial Sweetener
 Determination of Octinoxate in Sunscreen
 Determination of Iron in Lawn Fertilizer
 Determination of the Chemical Composition of OxyClean
 Determination of Iron in Egg Yolk

Laboratory Project Assignment Schedule

<u>Date</u>	<u>Assignment</u>
September 7	Project Selection Due
September 21	Project Procedure Due
October 9	Project Procedure Review Due
October 19	Introduction Draft Due
November 6	Revised Procedure Due
November 16	Revised Introduction Due
December 15	Final Project Report Due