

University of Rhode Island

Department of Chemistry CHM 212 Quantitative Analysis Lecture, Fall 2023

Professor: Dr. Jiyeon (Jay) Kim

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Office hours: Zoom, or visit in 374D after checking availability.

Textbook : Harris, Quantitative Chemical Analysis, **9th ed.** WH Freeman. (**Chapters 0-11**)

Chapter 0: Analytical Process
Chapter 1: Chemical Measurements
Chapter 2: Tools of the Trade
Chapter 3: Experimental Error
Chapter 4: Statistics
Chapter 5: Quality Assurance and Calibration Methods
Chapter 6: Chemical Equilibrium
Chapter 7: Let the Titrations Begin
Chapter 8: Activity and the Systematic Treatment of Equilibrium
Chapter 9: Monoprotic Acid-Base Equilibrium
Chapter 10: Polyprotic Acid-Base Equilibrium
Chapter 11: Acid-Base Titrations

Other resources: Skoog, Fundamentals of Analytical Chemistry, Thomson-Brooks/Cole
Chang, General Chemistry: the Essential Concepts, McGraw-Hill

Course objectives:

- To understand the goals of analytical chemistry, i.e., questions analytical chemists seek to answer, and the steps required to perform quantitative analysis.
- To understand how chemical reactions can be utilized for the quantitative measurement of one or more compounds (analytes) in a sample.
- To develop critical reasoning skills so that a student can calculate **the concentration of analyte in an unknown sample** (and the associated uncertainty, when applicable), given an appropriate set of data.
- To develop a greater understanding of relevant chemical equilibria (solubility, acid-base, complexation, and oxidation/reduction), and to apply this knowledge in solving different types of equilibrium-based problems (pH, principal species, fractional composition, etc.).
- To understand how the underlying methods of calibration (external standards, standard addition, and internal standardization) may be utilized for quantitative measurements in each.
- To understand the difference between accuracy and precision and the figures of merit used to quantify them (relative error and relative standard deviation).
- To be able to perform basic statistical tests such as the Grubbs-test, the t-test, and the F-test on one or more sets of data.

Studying:

This course moves quickly. We will cover each chapter approximately in one to two weeks, so you need to keep up with the workload. The material learned in each chapter will be used in subsequent chapters, so if you fall behind in the first few weeks, it would be hard for you to catch up again. You are also expected to retain the material you learned in freshman chemistry, especially error, moles/molarity calculations from the first semester of general chemistry and equilibrium calculations that were performed in the second semester.

Examples from your textbook:

Examples will frequently be used in a slightly modified way on quizzes and exams as a reward to the students who work them in a faithful manner.

Materials for Experiments

Experiments, lab schedule will be posted in the Brightspace.

Office Hours:

Email with subject CHM212 for an appointment. Zoom meeting would be one source for remote, but intimate guidance. Or, casually visit my office (Beaupre 374D). If you have questions related with the lab, contact **Anuradha KC (by email, google hangout, or visiting at Beaupre 340, anuradha.kc@uri.edu)**.

Accommodations for Sickness:

Any student under quarantine or with having a sickness needs to immediately contact me or Anuradha by email. We may arrange reasonable accommodations. For this accommodation, an official document or letter is needed.

Disability Accommodations:

Any student with a documented disability is welcome to contact me as early in the semester as possible so that we may arrange reasonable accommodations. Early notice at least one week ahead is necessary to set up an alternate location or time for exams or quizzes. Documentation from Disabilities Services is required, so contact first at 330 Memorial Union, 401-874-2098.

Sports or Other University Sponsored Events:

Please let me know the first week of classes if you need any accommodations. Any time conflict with lab session should be informed as early as possible.

Course Grades:

The course is graded strictly based on attendance, quizzes, exams and lab grades. **There is no extra credit!** Any errors in grading must be brought to my attention within one week of the material being handed back. No changes in any grades will be made after that point.

Scaling:

The scale for the course will be posted on the Brightspace after each exam. 65 % of the grade based on lecture material and 35 % on the lab. All grades will be posted on Brightspace as you proceed through the course, and tentative letter grades will be posted right after exams.

Lecture Grade: 65 % of Grade

Weekly Quiz: You will have a Take-home quiz after each chapter almost every week. We will have a recitation session () to review the quizzes right before the final exam.

Exams: Each exam will have tentatively 5–7 questions. There will be several parts per question. All calculation work must be shown to get credit. The final will be cumulative. Midterm and final are worth 50% of the total grade. **You cannot drop the final**, so if you miss it, you need to be in touch immediately to get it made up.

Attendance: TA will check the attendance in every class. Absence more than 5 times will have a zero point for the attendance. Unavoidable absence due to illness or accident etc. will need an official letter. Any personal excuse won't be acceptable. **The attendance will be uploaded in the Brightspace. No early leaving for Thanksgiving will be accommodated for either lecture or lab.**

Grading: Your course grade will be determined as outlined below. The tentative percentages are approximate ($\pm 5\%$).

Take-home quiz 10 %

Attendance 5 %

Midterm (October 26, 2023, in class) 20 %

Final (December 14, 2023, in class, 8 am – 10 am) 30 %

Grading scale: After each exam, tentative letter grades will be posted on the Brightspace.

Lab: 35 % of Grade

Lab Reports: Each lab is graded according to the rubric in the instructions given out in lab. Lab reports constitute 25 % of the overall grade

Lab Final: You will be expected to do quantitative lab work for your final that will be based on the techniques you learn in the lab. You will be expected to do out all calculations during the lab that you need to support your results. Your grade on the final will be based on the accuracy of the results and is worth 10 % of your overall grade in the course.

Note: You need C- to move on to upper courses of Chemistry in the chemistry department!

Academic Honesty

Academic dishonesty in any form is considered a serious offence, and disciplinary action will be taken immediately. The URI policy on academic honesty is detailed in the student handbook (available online), and it is summarized below:

Students are expected to be honest in all academic work. A student's name on any written work, including assignments, lab reports, papers, or exams, shall be regarded as assurance that the work is the result of the student's own thought and study. Work should be stated in the student's own words, properly attributed to its source. Students have an obligation to know how to quote, paraphrase, summarize, cite and reference the work of others with integrity. The following are examples of academic dishonesty.

- *Using material, directly or paraphrasing, from published sources (print or electronic) without appropriate citation*
- *Claiming disproportionate credit for work not done independently*
- *Unauthorized possession or access to exams*
- *Unauthorized communication during exams*
- *Unauthorized use of another's work or preparing work for another student*
- *Taking an exam for another student*
- *Altering or attempting to alter grades*
- *The use of notes or electronic devices to gain an unauthorized advantage during exams*
- *Fabricating or falsifying facts, data or references*
- *Facilitating or aiding another's academic dishonesty*
- *Submitting the same paper for more than one course without prior approval from the instructors.*

When there is an allegation of academic dishonesty, the instructor may:

- *Fail the student for the assignment, or recommend that the student fail the course.*

Note that all submitted work must be completed by each student in his or her own words: shared text is not permitted.

Anti-Bias Statement: We respect the rights and dignity of each individual and group. We reject prejudice and intolerance, and we work to understand differences. We believe that equity and inclusion are critical components for campus community members to thrive. If you are a target or a witness of a bias incident, you are encouraged to submit a report to the URI Bias Response Team at www.uri.edu/brt. There you will also find people and resources to help.

The University of Rhode Island occupies the traditional homelands of the Narragansett Nation. What is now the state of Rhode Island occupies the traditional homelands and waterways of the Narragansett Nation and the Niantic, Wampanoag and Nipmuc Peoples. We honor and respect the enduring and continuing relationship between these nations and this land by teaching and learning more about their histories and present-day communities, and by becoming stewards of the land we too inhabit. In addition, let us acknowledge the violence of conquest, war, and dispossession and of enslavement endured by Black and Indigenous communities in what is now the United States. Their contemporary efforts to endure in the face of colonialism must be acknowledged, respected and supported.