

CHEM 112: Introductory Chemistry II

Dr. Dan Albert

Spring 2023

Contact Information

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office: Caputo Hall 214

The best way to reach me is via university email.

Office Hours

I have an open door policy for meeting with you outside of class. If you ever walk by my door and it is open please feel free to stop to talk about any questions, comments, or concerns you have. The following times you can be guaranteed to find me in my office:

- Mondays from 12 - 2 pm in Caputo 214
- Tuesdays from 9 - 10:30 am in Caputo 214
- Thursdays from 9 - 10:30 am in Caputo 214

If you cannot make it to office hours please feel free to set-up an alternative time to meet with me by corresponding via email.

Course Description

Continuation of CHEM 111. The interactions of matter and energy thermodynamics, kinetics and electrochemistry. Equilibria in aqueous systems theory and practice. Coordination chemistry and descriptive chemistry of the elements.

Prerequisites

CHEM 111 with a grade of C- or higher; C or higher for chemistry majors. *Proficiency in algebra is essential.*

Course Purpose

An understanding of chemical principles is crucial in a wide variety of natural science disciplines as we are made-up of and constantly interact with chemicals. We will work to understand natural phenomenon through the use of chemical principles. In a broader sense, students in this class will benefit from knowledge of chemistry in their everyday lives. Things we encounter everyday such as cleaning products, pharmaceuticals, art supplies, and batteries are chemistry in action! Our goal is understand how and why chemical transformations take place and how they are useful!

The problem solving techniques and approaches we use in this class are broadly applicable to thinking about many questions you will encounter in your life!

Course Learning Objectives

- Students will predict outcomes for chemical processes using kinetics, equilibrium, and thermodynamics.
- Students will demonstrate appropriate and safe laboratory practices.
- Students will assess scientific claims using data.
- Students will explain natural phenomena using chemical theories and models.

Meeting Times

Lecture: TR from 10:50 - 12:05 in 149 Roddy Hall

- Section 01A

Recitation: Tuesday from 1:10 - 2:00 in 118 McNairy Library

Laboratory: Tuesday from 2:10 - 4:00 in 332 Caputo Hall

- Section 01B

Recitation: Wed from 9:00 - 9:50 in 118 McNairy Library

Laboratory: Tuesday from 10:00 - 11:50 in 332 Caputo Hall

- Section 01C

Recitation: Wed from 2:00 - 2:50 in 118 McNairy Library

Laboratory: Tuesday from 3:00 - 4:50 in 332 Caputo Hall

Required Materials

- Textbook: *Chemistry 2e* by Flowers, Theopold, Langley, and Robinson; OpenStax, 2019. ISBN: 978-1-947172-61-6
Good news: your textbook for this class is available for free online!
Your book is available in web view and PDF for free. You can also purchase on iBooks for \$4.99 or get a print version, if you prefer, on Amazon.com for about \$55.
You can use any of the formats. Web view is designed to work well on any device.
The textbook can be found at <https://openstax.org/details/books/chemistry-2e>
- Scientific Calculator: Your calculator for this course must be able to handle logarithms and exponents. This type of calculator can be found for around \$10.
- Laboratory Notebook: Permanently bound notebook (No perforations or binders)
- Regular access to D2L (<https://millersville.desire2learn.com/>) and university email
- Safety Goggles: Available from Bookstore or Chemistry Supply Room: Caputo 330

Class Environment

I value a learning environment that is engaging, respectful, and helpful. I ask that you help maintain a learning environment that meets these goals for everyone in the class. Anyone whose behavior is disruptive of the learning environment for others in the class will be asked to leave.

My goal is for you to feel comfortable, appreciated, fairly treated, and encouraged to challenge yourself and obtain success. *Please come talk to me if there is anything I can do to help support you in achieving success.*

ADA Program (Office of Learning Services) Americans With Disability Act — Millersville University (if you have a disability that requires accommodations under the Americans with Disabilities Act, please present your letter of accommodations and meet with me as soon as possible so that I can support your success in an informed manner. Accommodations cannot be granted retroactively. If you would like to know more about the Millersville University Office of Learning Services-please contact the office at 717-871-5554)

Grading

All grades in this course are assigned by the instructor of record. Your grade in this course will be calculated using the following components and weighting.

| Category | % of Total |
|-----------------|------------|
| Recitation Work | 10 |
| Skill Checks | 10 |
| Problem Sets | 10 |
| Regular Exams | 35 |
| Final Exam | 15 |
| Lab Assignments | 20 |
| Total | 100 |

Your final grade will be determined by your overall percentage grade in the course using the grading scheme described above.

In order to pass CHEM 112 you must have a grade higher than an F in both the lecture/recitation (Skill Checks, Problem Sets, Regular Exams, and Final Exam) and laboratory (Regular Labs and Laboratory Final) portions of the class. The cut-off percentages for each grade are given below. I reserve the right to lower grade cut-offs, but under no circumstances will the grade cut-offs be higher than those listed below.

| Grade Cut-off (%) | Letter Grade |
|-------------------|--------------|
| 93 | A |
| 90 | A- |
| 87 | B+ |
| 83 | B |
| 80 | B- |
| 77 | C+ |
| 73 | C |
| 70 | C- |
| 67 | D+ |
| 63 | D |
| 60 | D- |
| 0 | F |

Recitation Work

This course is an iPad enhanced course during recitation, offering individual student devices in each recitation meeting. These devices will be used to enhance your learning in this class.

Since the iPads are University-owned devices and will be shared across multiple sections of different courses during the Spring 2023 semester, here are a few guidelines to help us work together for your learning:

- iPads and Apple Pencils are borrowed for each class. Please return all pieces before you leave the classroom.

- I recommend you arrive a couple minutes early to log in to the device. You will need to authenticate through Microsoft Authenticator, so be sure to bring your authentication device too.
- The iPads come pre-loaded with apps we expect to use in class. You will not be able to add additional apps.
- Work completed on the iPad during class MUST be saved to OneDrive. Anything saved to the device during class will be wiped as soon as you log out.
- Responsible use: we are piloting iPads to enhance learning, help with problem solving skills, and connect you to learning materials to support your success in this class. Please use the devices accordingly.
- Please do not change the settings on the device.
- This is a pilot project, your feedback is valued and useful. You will be asked to provide feedback throughout the semester. The feedback will be used to make adjustments to the class and will impact future directions of iPad enhanced courses.
- During class, please only use the University iPad and no other devices, unless you talk with me before class, or it's during break.

We will use the iPads to explore chemistry simulations, to annotate and solve problems, and to work collaboratively on applying our learning to new situations. Each recitation session will include work on the iPad that will be submitted electronically at the end of the period. The lowest recitation work assignment will be dropped from the grade calculation.

Skill Checks

Skill Checks will be regularly assigned (typically twice a week) so that both you and I can see your progress in the course. Skill checks will need to be completed by 11:59 pm on Mondays and Fridays when assigned. These checks will consist of five questions on D2L. You will have up to three opportunities to take the skill checks and only your highest score will count towards your grade. The skill checks due Monday will be released Thursday. Skill checks due Friday will be released Tuesday. The lowest two skill checks will be dropped from the grade calculation.

Problem Sets

Ten problem sets will be given throughout the semester. Each problem set will consist of 5 graded problems. Detailed solutions to the graded problems will be available after the graded problems are collected. Each problem set is equally weighted in the problem set category. The lowest problem set will be dropped from the grade calculation.

Regular Exams

Three regular exams will be given during our regular lecture meeting times. Each exam will contain one or more of the following types of questions: multiple choice, short answer, and worked problems. All exams in this course are considered cumulative, but will focus on the material covered since the last exam. Each regular exam is equally weighted in the regular exam category. The dates of the exams are February 14, March 21, and April 25.

If your percentage grade on the final exam is higher than your lowest percentage regular exam score, your percentage grade on the final will replace your lowest regular exam score. For example, if you earn a 60% on Exam 1, a 85% on Exam 2, a 95% on Exam 3, and an 80% on the Final Exam, your 60% on Exam 1 will be replaced and become an 80% (your percentage score on the Final Exam).

Final Exam

A two hour cumulative (CHEM 111 and CHEM 112) final exam will be given at the end of the semester. The exam will be the standard American Chemical Society Exam for Introductory Chemistry. The final exam will take place on Tuesday May 2nd from 8:00 - 10:00 am.

Regular Labs

For every laboratory experiment each student must answer prelab questions, keep detailed records of the experiment, and complete calculations and answers to questions in their laboratory notebook. Each regular lab is equally weighted in the regular lab category.

Detailed information on keeping a laboratory notebook will be provided during our first laboratory.

Complete laboratory notebooks are due at the end of the lab period after the experiment has been completed.

Attendance, Absences, and Make-Ups

Attendance at every lecture, recitation, and lab is expected. If you must miss a lecture or recitation, please see a fellow classmate for notes. I will post all handouts and presentations during the semester to D2L.

Late or Make-Up Problem Sets, Labs, and Exams will be allowed if special circumstances occur. Prior notification is expected unless it is an emergency situation. Some examples of special circumstances are below.

- Required religious observation
- Participation in a required Millersville University event

- Armed forces related training or drills
- Medical Illness/Emergency
- Death in the family
- If you feel that you have a special circumstance that is of similar importance to the items listed above, please come talk with me as soon as possible and I will work with you to try and find a solution.

Suggestions for Course Success

My expectation is that you are working on CHEM 112 material for a minimum of 8 hours every week outside of class. This effort needs to be consistent throughout the semester to get the most out of this course.

- Work on chemistry a little bit every day.
Set aside 60 to 90 minutes each day to work on chemistry outside of class.
- Read the textbook and work example problems before coming to class.
- Attend, participate, and take notes at all lectures and recitations.
Ask questions during class. I love to get questions during class.
Take notes to capture key points and ideas.
- Re-Read the textbook after class and fill-in your notes with additional details.
- Work at least five new problems a day.
At a minimum you should be working all of the suggested problems.
The way you work through a problem matters.
Try to work problems by minimally looking at your notes or the textbook.
Starting problems is the most difficult part. Give yourself five minutes.
Solve problems from start to finish by yourself.
- Utilize helpful resources.
Form study groups.
Come to recitation with questions.
Come to office hours.
Stop by my office and ask questions. We can always find a time to meet.
Regularly attend Chemistry Peer Learning Hours

Chemistry Peer Learning

Chemistry Peer Learning Hours are dedicated times available for students to come together and work on chemistry! If you are looking for a place to work on your chemistry assignments or need some help with your chemistry classes, Peer Learning Hours are here for you. No need to sign-up. Stop by at any or all of the Peer Learning Hours. All Peer Learning Hours are staffed by a chemistry tutor to assist you if needed.

Chemistry Peer Learning Schedule is available here: <https://www.millersville.edu/chemistry/tutoring.php>

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Important Dates

| Date | Event |
|----------|--|
| 1/24 | Last Day to Add or Drop a Course Online |
| 3/6-3/10 | No Classes for Spring Break |
| 3/31 | Last Day to Withdraw from Course and Receive a 'W' |
| 5/2 | CHEM 112 Final Exam at 8:00 am |

University Policies

- Academic Honesty Policy link Governance Manual (millersville.edu); for additional information please see the following: What is Academic Integrity? — Millersville University
- Attendance Policy link: Class Attendance Policy — Millersville University
- Inclusion Statement: Millersville University Inclusion Statement — Millersville University
- Land Acknowledgement: Land Acknowledgement — Millersville University
- Policy on Delays and Cancellations link Policy on Delays & Cancellations — Millersville University
- Preferred Name FAQs link Preferred Name FAQs — Millersville University
- Privacy Rights under FERPA link Annual Notification of Student Rights Under FERPA — Millersville University
- Student Conduct and Community Standards Handbook link studentcodeofconduct.pdf (millersville.edu)
- Title IX Reporting Requirements and the Faculty member: Millersville University is committed to maintaining a safe education environment for all students. In compliance with Title IX of the Education Amendments of 1972 and guidance from the Office for Civil Rights, the University requires faculty members to report incidents of sexual violence shared by students to the University's Title IX Coordinator. The only exceptions to the faculty member's reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. Faculty members are obligated to report sexual violence or any other abuse of a students who was, or is, a child (under 18 years of age) when the abuse allegedly occurred to the person. Information about Title IX, resources and reporting can be found at: What is Title IX — Millersville University

Course Schedule

The instructor reserves the right to change this schedule as needed. Any changes will be communicated via an in-class announcement.

| Week | Topics | Reading | Exam Dates | Laboratory Exercises |
|------|-------------------------------|-----------------------------|-----------------------------|--|
| 1/16 | Chemical Kinetics | 12.5 - 12.6, 12.1 - 12.2 | | Lab Introduction and Check-In |
| 1/23 | Chemical Kinetics | 12.3 - 12.4, 12.7 | | Kinetics Part A |
| 1/30 | Entropy and Free Energy | 16.1 - 16.3 | | Kinetics Part B |
| 2/6 | Entropy and Free Energy | 16.4, 13.1 | | Qualitative Analysis I |
| 2/13 | Chemical Equilibrium | 13.2 - 13.3 | Exam 1 on 2/14 | Qualitative Analysis I |
| 2/20 | Chemical Equilibrium | 13.4 | | Equilibrium Constant using UV-Vis |
| 2/27 | Acids and Bases | 14.1 - 14.2 | | Le Chatelier's Principle |
| 3/6 | BREAK | | | |
| 3/13 | Acids and Bases | 14.3 - 14.7 | | Titration Curves and Ionization Constant |
| 3/20 | Solubility and Ion Equilibria | 15.1 | Exam 2 on 3/21 | Qualitative Analysis II |
| 3/27 | Solubility and Ion Equilibria | 15.2 - 15.3 | | Qualitative Analysis II |
| 4/3 | Electrochemistry | 17.1 - 17.4 | | Penny's Worth of Chemistry |
| 4/10 | Electrochemistry | 17.5 - 17.7 | | Electrolysis |
| 4/17 | Nuclear Chemistry | 21.1 -21.6 | | Qualitative Analysis III |
| 4/24 | Representative Elements | 18 and 19 | Exam 3 on 4/25 | Qualitative Analysis III and Check-Out |
| 5/1 | Final Exam | | Final on 5/2 at 8 am | |