CHEM 112: Introductory Chemistry II

Dr. Dan Albert

Spring 2019

Contact Information

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phone: 717-871-7391
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 - 1 pm in Caputo 214
- Tuesdays from 4 - 5 pm in Caputo 214
- Thursdays from 2 - 4 pm in Caputo 214
- Fridays from 12 - 1 pm 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

- Be able to use qualitative and quantitative skills to solve chemistry problems (Problem Solving)
- Be able to use chemical theories to explain chemical and physical phenomena (Critical Thinking)
- Be able to organize, present, and interpret data to draw reasonable conclusions (Communication)
- Be able to explain natural phenomena encountered outside the classroom using chemical principles
- Be able to use appropriate and safe laboratory procedures

Meeting Times

- Section 01A
  Lecture: MWF from 11:00 - 11:50 am in 102 Brossman Hall
  Recitation: Monday from 1:00 - 1:50 pm in 153 Roddy Hall
  Laboratory: Monday from 2:00 - 3:50 pm in 332 Caputo Hall
- Section 01B
  Lecture: MWF from 11:00 - 11:50 am in 102 Brossman Hall
  Recitation: Tuesday from 8:00 - 8:50 am in 153 Roddy Hall
  Laboratory: Tuesday from 9:00 - 10:50 am in 332 Caputo Hall

- Section 01C
  Lecture: MWF from 11:00 - 11:50 am in 102 Brossman Hall
  Recitation: Tuesday from 1:10 - 2:00 pm in 153 Roddy Hall
  Laboratory: Tuesday from 2:10 - 4:00 pm in 332 Caputo Hall

Required Materials

  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 [http://www.openstax.org/details/chemistry](http://www.openstax.org/details/chemistry)

- 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.
  *Mobile devices and calculator programs/internal memory are not acceptable for use on exams*

- Laboratory Notebook: Permanently bound notebook (No perforations or binders)

- Safety Goggles: Available from Bookstore or Chemistry Supply Room: Caputo 330

- Regular access to D2L ([https://millersville.desire2learn.com/](https://millersville.desire2learn.com/)) and university email

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.*
Title IX

Millersville University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to meet this commitment, comply with Title IX of the Education Amendments of 1972, 20 U.S.C. §1681, et seq., and act in accordance with guidance from the Office for Civil Rights, the University requires faculty members to report to the University’s Title IX Coordinator incidents of sexual violence shared by students. The only exceptions to the faculty members 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 to the person designated in the University Protection of Minors policy incidents of sexual violence or any other abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred.

Information regarding the reporting of sexual violence, and the resources that are available to victims of sexual violence, is available at [http://www.millersville.edu/socialeq/title-ix-sexual-misconduct/index.php](http://www.millersville.edu/socialeq/title-ix-sexual-misconduct/index.php)

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.

<table>
<thead>
<tr>
<th>Category</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skill Checks</td>
<td>10</td>
</tr>
<tr>
<td>Problem Sets</td>
<td>10</td>
</tr>
<tr>
<td>Regular Exams</td>
<td>40</td>
</tr>
<tr>
<td>Final Exam</td>
<td>20</td>
</tr>
<tr>
<td>Lab Assignments</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

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.
<table>
<thead>
<tr>
<th>Grade Cut-off (%)</th>
<th>Letter Grade</th>
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</thead>
<tbody>
<tr>
<td>93</td>
<td>A</td>
</tr>
<tr>
<td>90</td>
<td>A-</td>
</tr>
<tr>
<td>87</td>
<td>B+</td>
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<tr>
<td>83</td>
<td>B</td>
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<tr>
<td>80</td>
<td>B-</td>
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<tr>
<td>77</td>
<td>C+</td>
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<tr>
<td>73</td>
<td>C</td>
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<tr>
<td>70</td>
<td>C-</td>
</tr>
<tr>
<td>67</td>
<td>D+</td>
</tr>
<tr>
<td>63</td>
<td>D</td>
</tr>
<tr>
<td>60</td>
<td>D-</td>
</tr>
<tr>
<td>0</td>
<td>F</td>
</tr>
</tbody>
</table>

**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 (https://millersville.desire2learn.com/). 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 after class on Friday and the skill checks due on Fridays will be released after class on Wednesdays.

**Problem Sets**

Ten problem sets will be given throughout the semester. Each problem set will consist of 5 graded problems. Suggested problems for the course consist of the questions that have provided solutions at the end of each reading. I strongly suggest that you attempt the suggested problems before working on the graded problems. The graded problems are typically the most difficult problems and it is best to build towards solving them. 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.

All problem sets and detailed solutions can be accessed via D2L (https://millersville.desire2learn.com/)

**Regular Exams**

Four 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.
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, a 75% on Exam 4 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 Friday May 10th 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 not be allowed except under special circumstances and prior notification is required unless it is an emergency situation. Some examples of special circumstances are below.

- Required religious observation
- Participation in a Millersville University athletic 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
Academic Honesty

The Millersville University Academic Honesty Policy states that:

*Students of the University are expected to be honest and forthright in their academic endeavors. To falsify the results of one's research, to steal the words or ideas of another, to cheat on an examination, to allow another person to commit, or assist another in committing an act of academic dishonesty, corrupts the essential process by which knowledge is advanced.*

The entire academic honesty policy can be found at [http://www.millersville.edu/english/for-faculty/academic-integrity/index.php](http://www.millersville.edu/english/for-faculty/academic-integrity/index.php)

All work that is turned in for a grade should be completed individually by the person whose name appears on the work. Students found to have violated the academic honesty policy will receive a score of zero on the assignment. Repeated instances of academic misconduct will be given the harshest punishment.

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 Hours Schedule:

• Tuesdays, Wednesdays, and Thursdays from 1 - 3 pm in Roddy 259

• Tuesdays, Wednesdays, and Thursdays from 5 - 7 pm in Roddy 259

Important Dates

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>1/29</td>
<td>Last Day to Add or Drop a Course Online</td>
</tr>
<tr>
<td>3/11-3/17</td>
<td>No Classes for Spring Break</td>
</tr>
<tr>
<td>4/5</td>
<td>Last Day to Withdraw from Course and Receive a ‘W’</td>
</tr>
<tr>
<td>5/10</td>
<td>CHEM 112 Final Exam at 8:00 am</td>
</tr>
</tbody>
</table>
Course Schedule

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

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics</th>
<th>Reading</th>
<th>Exam Dates</th>
<th>Laboratory Exercises</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/22</td>
<td>Chemical Kinetics</td>
<td>12.5 - 12.6, 12.1 - 12.2</td>
<td></td>
<td>Lab Introduction and Check-In</td>
</tr>
<tr>
<td>1/29</td>
<td>Chemical Kinetics</td>
<td>12.3 - 12.4, 12.7</td>
<td></td>
<td>Kinetics Part A</td>
</tr>
<tr>
<td>2/4</td>
<td>Entropy and Free Energy</td>
<td>16.1 - 16.3</td>
<td></td>
<td>Kinetics Part B</td>
</tr>
<tr>
<td>2/11</td>
<td>Entropy and Free Energy</td>
<td>16.4, 13.1</td>
<td><strong>Exam 1 on 2/15</strong></td>
<td>Rate Law with Crystal Violet</td>
</tr>
<tr>
<td>2/18</td>
<td>Chemical Equilibrium</td>
<td>13.2 - 13.3</td>
<td></td>
<td>Qualitative Analysis I</td>
</tr>
<tr>
<td>2/25</td>
<td>Chemical Equilibrium</td>
<td>13.4</td>
<td></td>
<td>Qualitative Analysis I and III</td>
</tr>
<tr>
<td>3/4</td>
<td>Acids and Bases</td>
<td>14.1 - 14.2</td>
<td><strong>Exam 2 on 3/8</strong></td>
<td>Qualitative Analysis III</td>
</tr>
<tr>
<td>3/11</td>
<td>SPRING BREAK</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3/18</td>
<td>Acids and Bases</td>
<td>14.3 - 14.6</td>
<td></td>
<td>Le Chatelier’s Principle and Equilibrium Constant Part A</td>
</tr>
<tr>
<td>3/25</td>
<td>Acids and Bases</td>
<td>14.7, 15.1</td>
<td></td>
<td>Equilibrium Constant Part B</td>
</tr>
<tr>
<td>4/1</td>
<td>Solubility and Ion Equilibria</td>
<td>15.2 - 15.3</td>
<td><strong>Exam 3 on 4/5</strong></td>
<td>Titration Curves and Ionization Constant</td>
</tr>
<tr>
<td>4/8</td>
<td>Electrochemistry</td>
<td>17.1 - 17.4</td>
<td></td>
<td>Buffer Systems</td>
</tr>
<tr>
<td>4/15</td>
<td>Electrochemistry</td>
<td>17.5 - 17.7</td>
<td></td>
<td>Design the Best Airbag</td>
</tr>
<tr>
<td>4/22</td>
<td>Nuclear Chemistry</td>
<td>21.1 -21.6</td>
<td></td>
<td>Electrolysis</td>
</tr>
<tr>
<td>4/29</td>
<td>Representative Elements</td>
<td>18 and 19</td>
<td><strong>Exam 4 on 5/3</strong></td>
<td>Coordination Compounds of Copper</td>
</tr>
<tr>
<td>5/6</td>
<td>Review and Final Exam</td>
<td></td>
<td><strong>Final Exam on 5/10 at 8:00 am</strong></td>
<td></td>
</tr>
</tbody>
</table>