

# CHEM 1220 – Principles of Chemistry II

## Syllabus

Instructor: Dr. Shawn M. Miller

Fall Term, 2017

Email: shawn.miller@usu.edu

Office Hours: Monday/Wednesday 2:30

PM – 3:30 PM

Widtsoe 339

## Course Lecture/Recitation Times & Locations:

Section (CRN)	Time	Day(s)	Location
Lecture 001 (40997)	1:30 PM to 2:20 AM	M/W/F	Widtsoe Hall 007
Recitation 501 (41001)	1:30 PM to 2:20 PM	T	Engineering Laboratory 248
Recitation 502 (41006)	8:30 AM to 9:20 AM	F	Health Phys Ed & Rec 116
Recitation 503 (41007)	9:30 AM to 10:20 AM	F	Health Phys Ed & Rec 114A
Recitation 504 (41008)	10:30 AM to 11:20 AM	F	Health Phys Ed & Rec 116

## Prerequisite:

Chem 1210

## Required Materials:

Text: Brown, LeMay, Bursten, Murphy, Woodward, Stoltzfus *Chemistry: The Central Science*, 13<sup>th</sup> ed.; Pearson Education, Inc. (ISBN: 978-0-321-91041-7)

Calculator: A non-programmable scientific calculator is recommended for use in Lecture and on Exams. Programmable calculators are permitted during Exams only if their memory is cleared by the Testing Center. Other electronic devices, including phones, are not permitted during Exams.

Online Homework: Sapling Learning online homework system ([www.saplinglearning.com](http://www.saplinglearning.com)). Can be purchased through the bookstore, but it is cheaper to purchase directly from Sapling Learning.

## Optional Materials:

iclicker: iclicker 2s are used during the Lecture period and extra credit is awarded through the use of iclickers. iclickers must be registered by the beginning of class. To register an iclicker, use the link in the navigation bar on Canvas.

## **Supplementary Course Assistance:**

SI Information: Jessica Burt (contact: [jessica.burt@aggiemail.usu.edu](mailto:jessica.burt@aggiemail.usu.edu) or Canvas)  
Session Times: Tuesday/Thursday 6:30 PM – 7:30 PM in ENGR 302

UTF Information: Noah Thackeray (contact: [noah.thackeray@aggiemail.usu.edu](mailto:noah.thackeray@aggiemail.usu.edu) or Canvas)  
Session Times: Monday/Friday 5:00 PM – 6:00 PM in Room TBA

TA Information: Camden Debruler (contact: [camden.debruler@usu.edu](mailto:camden.debruler@usu.edu) or Canvas)  
Office Hour Times: Tuesday 3:00 PM – 4:00 PM in ML 351

## **Course Overview**

CHEM 1220 is the second in a two-semester series of general chemistry courses and is targeted towards science and engineering students that builds upon the lessons learned in Chem 1210 and meets three times a week. There will be assigned online Sapling Learning homework sets. Recitations will be held once a week for additional practice with course material. There will be an online Post-Week Quiz on Canvas at the end of each week designed to help prepare students for the Exams. There will be three 60-minute Midterm Exams in addition to a 120-minute Final exam all of which will be proctored on Canvas via the Testing Center.

## **Course Learning Objectives**

CHEM 1220 is a Lecture course designed to continue the education process began in Chem 1210. By reading the textbook prior to the Lecture period, you will obtain a basic understanding of the upcoming Lectures' topics. By attending, taking notes during, and asking questions during Lecture periods, you will expand and refine your understanding of the course material. You will demonstrate proficiency of the course material through weekly in-Lecture clicker questions, Recitation worksheets, online Canvas Quizzes, and online Sapling Learning homework problem sets. You will demonstrate mastery of the course material through Midterm Exams and a Final Exam.

### **By the end of this course, you will be able to...**

- ...list key fundamental chemistry theories and principles related to reaction kinetics, chemical equilibrium, acids and bases, solubility, thermodynamics, electrochemistry, fundamental nuclear chemistry, fundamental inorganic chemistry, fundamental organic and biological chemistry, recall their meaning, and differentiate between related, but distinct, ideas. For example, students will be able to list all discussed types of rate plots (zero-, first-, and second-order), recall why they are different, and be able to differentiate between them.
- ...use fundamental chemistry theories and principles to explain or predict a result when presented with a chemistry scenario. For example, students will be able to say what happens to the pH of an acidic solution when a base is added to that solution.
- ...identify the appropriate equation(s) and problem-solving tool(s) needed to solve a chemistry problem and then use algebra and other fundamental mathematical skills to

solve the problem. For example, students will be able to set up and utilize equilibrium constant expressions to determine the concentration of a compound at equilibrium.

A detailed set of Learning Objectives for each chapter is located at the end of this syllabus.

### **You will prepare for and practice achieving these objectives by...**

- ...reading the textbook while taking notes.
- ...attending and taking notes during Lecture periods.
- ...completing online Sapling Learning homework sets.
- ... taking weekly graded online Post-Week Quizzes on Canvas.
- ...asking for help via Office Hours, Piazza, or e-mail.
- ...optionally attending UTF or SI sessions for problem solving and further assistance.

### **You will be assessed on how you have achieved these objectives using...**

- ... one Getting Started Quiz on Canvas.
- ...the aforementioned online Sapling Learning homework sets.
- ... the aforementioned Quizzes on Canvas.
- ...three Midterm Exams.
- ...one Final Exam.

### **Course Communication**

**Piazza** is a free online system designed for students to have access to rapid and efficient help from classmates, TAs, and the instructor simultaneously. **Piazza is not to be used to convey personal information.** Email the instructor directly if you need to discuss personal information.

For academic questions, rather than emailing questions about course material to the instructor and hoping for a quick response, you are strongly encouraged to post your questions on Piazza. The instructor, TA, UTF, SI, and your fellow students can answer the question on Piazza, making it more likely that someone can answer your question quickly. Maybe you'll even get lucky and someone will have already asked the question you were going to ask and got it answered! Students are not to provide complete answers or explanations, but are encouraged to guide their fellow students to complete answers or explanations. You have the option of posting anonymously to each other, but the instructor will always be able to see your identity. Enroll in the course by creating a Piazza account by going to <https://piazza.com/signup> or by clicking on the "Piazza" link in the sidebar on Canvas, searching for "Chem 1220", and enrolling as a student.

You are always welcome to e-mail the instructor, TA, UTF, and/or SI with questions. Please include your full name and A-Number in your email. We will attempt to respond to your e-mails in a timely manner, but I have responsibilities outside of the course that may prevent us from doing so, and we ask you to exercise patience after sending e-mail. When contacting the instructor by email, it is recommended that you send the message through Canvas.

The instructor will hold regular office hours as listed in this syllabus as well as by request.

Course announcements will be made using Canvas and Piazza. You can set Canvas to send you an email when a course announcement is made, but the instructor will not send regular mass reminder emails. **You are expected to check Canvas and/or Piazza at least once a day and are responsible for any information in the announcements.** “But I did not know” will not be an acceptable excuse for being unaware of information in course announcements.

### **Getting started in the course**

Read the course syllabus. Once that is done, your first assessment is a “Getting Started” online quiz located on Canvas that will cover course policy as discussed in the syllabus. This Quiz opens at the start of the semester and remains open until 1:00 PM on Friday, September 8. The Getting Started quiz will be graded immediately upon completion and may be attempted an unlimited number of times. Correct answers will not be shown upon completion of the Getting Started Quiz, but you will be able to view your responses. If multiple attempts are made, the **latest** score will be accepted. **If you see no score in your Grades, no attempt was submitted.** The Getting Started Quiz score cannot be dropped.

USU welcomes students with disabilities. If you have, or suspect you may have, a physical, mental health, or learning disability that may require accommodations in this course, please contact the Disability Resource Center (DRC) as early in the semester as possible (University Inn #101, 435-797-2444, [drc@usu.edu](mailto:drc@usu.edu)). All disability related accommodations must be approved by the DRC. Once approved, the DRC will coordinate with faculty to provide accommodations.

### **Lectures and Recitations**

**It is assumed that you read textbook sections, as outlined in the schedule at the end of this syllabus, prior to discussing them in Lecture.** You are strongly encouraged to take notes while reading the textbook and then supplement those notes with Lecture. You are not expected to understand the material simply by reading the textbook, but reading the chapter will build a foundation that we can expand and refine through our discussions in Lecture. PDF copies of blank Lecture PowerPoint slides will be available on Canvas that can be printed ahead of each Lecture if you wish. Each Lecture will be recorded and available on Canvas for viewing at your pleasure.

You must be registered for a recitation section (CHEM 1220 sections 501-504). Recitations will involve guided, group problem sessions. Participation in each Recitation is worth 5 points. The lowest Recitation score will be dropped, resulting in a total of 50 points for Recitations to be applied to the final grade.

## iClicker Questions

iClicker questions will be asked through the Lecture period and will be used as a way to assess class understanding of topics by providing immediate feedback to both the instructor and you. These questions must be answered individually, but consulting your notes and discussing with your classmates is allowed. It is your responsibility to register your iClicker either through the iClicker service on Canvas or at [iclicker.com](http://iclicker.com), and to remember to bring your iClicker, in working order, to class each day. iClicker questions will be utilized on Day 1, but student performance will not be recorded until the third Lecture period on Friday, September 1.

To encourage you to attend, prepare for, and be attentive during lectures, you **may earn up to 12 points extra credit** via iClicker questions. 6 of those points are allocated to participating in iClicker questions, and the remaining 6 points are allocated to answering iClicker questions correctly. The amount of extra credit awarded will be based on the percentage of iClicker questions answered by each student based on the total number of questions asked and the percentage of correct answers to iClicker questions based on the total number of questions asked.

## Homework

There will be 11 on-line homework sets, administered through Sapling Learning and must be completed on your own time. Each homework set, worth 11 points, will open on the day the topic of the first question is discussed in lecture and will close at 1:00 PM on the day of the Exam they are associated with. The homework sets will involve a variety of interactive questions. You may use your textbook and notes, but it is suggested you attempt the problems alone at first. You can have as many attempts as necessary for each problem, but 5% will be deducted from a problem for each incorrect answer. The lowest Sapling Learning score will be dropped at the end of the course.

See the following instructions for Sapling Learning enrollment. **Remember to input your A-number correctly or you cannot be given credit for the Homework assignments.**

### Registering for Sapling

For instructions on how to enroll in Sapling Learning, please proceed to <https://community.macmillan.com/docs/DOC-5809-sapling-learning-creating-accounts>.

Once you have registered and enrolled, you can log in at any time to complete or review your homework assignments. During sign up or throughout the term, if you have any technical problems issues, complete the form at <https://community.macmillan.com/community/digital-product-support/college-students-support-community>. The Sapling Learning support team is almost always faster and better able to resolve technical issues than your instructor.

### Inputting A-number

- 1) Click "Profile" on the left hand menu
- 2) Click "Edit Profile" from the top menu
- 3) Click "Show Advanced" on right side
- 4) Scroll to the bottom
- 5) In put your A-number, as A##### (capital A), in the box labeled "ID number"
- 6) Click "Update Profile"

### **Quizzes**

There are 13 graded Post-Week Quizzes in the course. Each week, the Quiz will open at 1:00 PM every Friday and will be due the following Monday at 11:00 AM. The one exception is Post-week Quiz 13, which will be due on Friday, December 8 to allow you to use it to prepare for the Final Exam. These Quizzes contain 10 questions each worth 1 point about material covered in the previous week. You will have 30 minutes to complete the Post-week Quiz and you may use your textbook and notes, but you must work alone. You should treat Post-Week Quizzes as practice for the Exam in terms of both format and content. You may take each Post-Week Quiz twice to account for any technical difficulties you encounter, such as losing power or logging out accidentally. After successfully completing the Quiz, you may choose to retake the Quiz to try and maximize your score, but note that only the **last** attempt will be accepted. Therefore, if your second attempt at the Quiz has a lower score than the first attempt, the second attempt's score is still what will be counted as your score for the Quiz. The lowest two Post-Week Quiz scores will be dropped at the end of the course.

### **Examinations**

There will be three 60-minute Exams, worth 100 points each, that will be administered on Canvas in the Testing Center according to the following schedule:

First Exam:	Wednesday, September 27 to Friday, September 29
Second Exam:	Wednesday, October 25 to Friday, October 27
Third Exam:	Monday, November 20 to Tuesday, November 21

These Examinations will consist of 25 questions worth 4 points each. Question formats may include, but are not limited to, multiple choice, multiple answer, matching, and fill-in (dropdown).

Make-up Exams for missed Exams may be granted upon petitioning the instructor only in the following situations: 1) documented and acceptable excuses for illness when verified by a doctor's note; 2) a family emergency when verified by a note from your academic advisor; 3) a regularly scheduled university-sanctioned conflict, such as a sports competition the student is participating in, but only when the instructor is notified well in advance of the conflict and verified with a note from the person in charge of the activity containing the specific reasons for the absence. Absences due to reasons not considered by the university to be excused absences, such as weddings, are not eligible for make-up Exams.

The only materials permitted in the Testing Center will be writing utensils and calculators (scientific preferred, graphing only if the Testing Center clears the memory). The Testing Center

will provide laptops and scratch paper. Appoints for the Testing Center are made through their website at <http://testing.usu.edu/>. Ensure you bring a form of ID with you in order to Check-in for your Testing Center appointment.

A Final Examination will be held in the Testing Center on from Monday, December 11 to Tuesday, December 12.

### **Academic Integrity**

All Utah State University academic integrity policies are strictly enforced. All students at Utah State University agree to be bound by the following Honor Pledge “I pledge, on my honor, to conduct myself with the foremost level of academic integrity.” See the following for further information: <https://studentconduct.usu.edu/studentcode/article5>. Students found guilty of academic misconduct on any assignment will, **at minimum, be given a zero for the assignment and have the full value of that assignment deducted from their final course grade**. Actions up to and including a failing grade for the course are options available to the instructor.

### **Course Assessment**

Approximately halfway through the course, the instructor will solicit feedback through an anonymous survey on Canvas. The purpose of the survey will be to determine student opinions of the course up to that point and ask for suggestions on what could be done to improve the course for the rest of the semester and in subsequent semesters. The instructor will know who completed the survey, but will be unable to match survey responses to students. Each student who responds to the survey will be granted 4 extra credit points.

A Pre-test/Post-test approach will be used to measure comprehension and teaching of important concepts. The Pre-test will be administered online through Canvas. The Pre-test will be comprised of 20 questions with duration of 60 minutes. The multiple choice questions of the Pre-test will reappear in the Final Exam, in altered form, to assess teaching and learning progress during the semester. If weaknesses are observed in specific subject areas, teaching methods will be reevaluated. An all-or-nothing 10 point reward will be given for completing the Pre-test. The Pre-test opens at the beginning of the course and is due at 1:00 PM on Monday, September 4.

## Grading

The total score for each type of assignment represent totals after appropriate lowest scores have been dropped.

Getting Started Quiz	20
Pre-Test	10
Recitation Worksheets	50
Chapter Homework Problems	100
Post-Week Quizzes	120
First Exam	100
Second Exam	100
Third Exam	100
Final Exam	200
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Total points	800

Percentage of Points Earned	Grade
88 – 100	A-, A
77 – 87	B-, B, B+
60 – 76	C-, C, C+
50 – 59	D, D+
< 50	F

Final course scores will be rounded to the nearest whole number. The administration of Chem 1220, including the issuing of grades of Incomplete, will adhere to the outlines in the USU General Catalog.



## Fall 2017 Schedule

**Please look carefully at the following schedule for the correct order of Lectures. Note that this schedule is approximate and may adjust slightly depending on course pace.**

**Red text** denotes the days Exams will be proctored. **Blue text** denotes holidays where Lecture will not be held. Note that the first Post-Week Quiz (P-Quiz) will be due on Monday, September 4, which is a holiday.

Week	Day	Date	Lecture	Topic	Chapter	Recitation	Assignment Due	
1	M	8/28	1	Course intro, Reaction rates	14	none		
	W	8/30	2	Concentration and rates	14			
	F	9/1	3	activation energy	14			
2	M	9/4	<b>Labor Day</b>				P-Quiz 1	
	W	9/6	4	Reaction mechanism	14	all		
	F	9/8	5	Equilibrium	15			
M	9/11	6	Equilibrium constants	15	all		P-Quiz 2	
W	9/13	7	Le Chatelier's Principle	15				
F	9/15	8	Water, Acid/Base	16				
4	M	9/18	9	pH, strong acids/bases	16	all	P-Quiz 3	
	W	9/20	10	Weak acids/bases, $K_a$ , $K_b$	16			
	F	9/22	11	Buffers	16			
5	M	9/25	12	catch up, prepare for exam 1	16	none	P-Quiz 4	
	W	9/27	<b>First Exam (Ch 14-16)</b>					HW 1,2, and 3
	F	9/29	13	Common ions	17			
6	M	10/2	14	Buffers, acid-base	17	all		
	W	10/4	15	Titrations	17			
	F	10/6	16	Solubility	17			
7	M	10/9	17	Solubility (cont)	17	all	P-Quiz 5	
	W	10/11	18	Spontaneous processes	19			
	F	10/13	19	Entropy and the second law	19			
8	M	10/6	20	Entropy in reactions	19	all	P-Quiz 6	
	W	10/18	21	Gibb's Free Energy	19			
	R	10/19	22	Gibb's Free Energy	19			
	F	10/20	<b>Fall Break (Meet on Thurs. 10/19)</b>					
9	M	10/23	23	catch up, prepare for Exam 2		none	P-Quiz 7	
	W	10/25	<b>Second Exam (Ch 17-19)</b>					HW 4, 5, and 6
	F	10/27	24	Redox reactions	20			
10	M	10/30	25	Voltaic cells	20	all	P-Quiz 8	
	W	11/1	26	EMF	20			
	F	11/3	27	Batteries	20			
11	M	11/6	28	Electrolysis	21	all	P-Quiz 9	
	W	11/8	29	Radioactivity, nuclear decay	21			
	F	11/10	30	Energy considerations	21			
12	M	11/13	31	Periodic concepts	22	all	P-Quiz 10	
	W	11/15	32	Noble gases/halogens/oxygen	22			
	F	11/17	33	catch up, prepare for Exam 3				
13	M	11/20	<b>Third Exam (Ch 20-22)</b>			none	P-Quiz 11 and HW 7, 8, and 9	
	W	11/22	<b>Thanksgiving Break</b>					
	F	11/24	<b>Thanksgiving Break</b>					
14	M	11/27	34	Metals, coordination complexes	23(23,24)	all		
	W	11/29	35	Isomers, colors and magnets	23(23,24)			
	F	12/1	36	Organics-functional groups	24(25)			
15	M	12/4	37	Organics	24(25)	all	P-Quiz 12	
	W	12/6	38	Peptides/sugars/nucleic acids	24(25)			
	F	12/8	39	catch up, Prepare for final exam			P-Quiz 13	
16	M/T	12/11 – 12/12	<b>Final Exam</b>				HW 10 and 11 (on Monday)	

for BLB 12th edition chapters 23 and 24 are combined as chapter 22, and organic chemistry is chapter 24.  
For earlier editions chapters 23-25 cover the material in chapters 23-24 of the 12th edition

## Chapter Learning Objectives

**Chapt 14:** Describe reaction rates in terms of zero, 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> order processes

Describe reaction rates as a function of temperature

Predict reaction half-lives given initial conditions

Differentiate between the plots of 1<sup>st</sup> order and 2<sup>nd</sup> order reactions

Describe the action of catalysis on a chemical reaction

Describe reactions in terms of elementary steps and rate-determining steps

**Chapt 15:** Write equilibrium constant expressions

Perform calculations of concentrations, pressures using  $K_{eq}$  information

Predict the direction of a reaction using the reaction quotient

Explain Le Chatelier's Principle

**Chapt 16:** Cite essential definitions of acids and bases

Utilize the autoionization of water to define pH and pOH,  $K_w$ ,  $pK_w$

Employ  $K_a$ ,  $K_b$  values to calculate pH, pOH of solutions of weak acids, weak bases, and salts

Describe chemical factors that contribute to the strength of acids and bases

**Chapt 17:** Apply concepts of the Common Ion effect to design and construct acid/base buffer systems

Calculate acid/base titration curves and predict end-point conditions

Describe and apply  $K_{sp}$  values to determine solubility of inorganic solids

Describe the precipitation and separation of ions utilizing  $K_{sp}$  information

**Chapt 19:** Describe and apply concepts of chemical spontaneity and the 2<sup>nd</sup> Law of Thermodynamics

Describe and apply the concepts of entropy to chemical reactions

Use Gibb's Free Energy to predict chemical equilibrium

**Chapt 20:** Balance chemical reactions that involve changes in oxidation states

Express oxidation/reduction in terms of half reactions

Describe voltaic cells and calculate potentials using standard reduction potentials

Predict the spontaneity of oxidation/reduction reactions

Employ the Nernst Equation to calculate cell potentials and chemical concentrations

Describe the essential reactions related to common battery systems and fuel cells

Describe the chemical reactions of corrosion

**Chapt 21:** Describe and differentiate between fundamental types of radioactivity and radioactive processes

Predict nuclear stability based on proton/neutron ratios

Apply 1<sup>st</sup> order kinetics for radioactive decay

Compare the energetic and mass aspects of nuclear fission and nuclear fusion

**Chapt 22:** Describe the fundamental aspects of the reactivity of non-metal elements, including hydrogen, the Noble gases, the halogens

**Chapt 23:** Describe the structure and bonding in simple coordination complexes of transition metals like Fe, Cu

Predict simple electronic configurations for transition metal ions using the periodic table

Predict magnetism using simple models of Crystal Field Theory

Discuss how the color of transition metal complexes is related to d-orbital splitting

**Chapt 24:** Identify and draw the structure of hydrocarbon alkanes, alkenes, alkynes, and aromatics

Identify and draw the functional groups ethers, aldehydes, ketones, acids, esters, and amides

Identify the chemical structure of amino acids and polypeptides

Identify the chemical structure of carbohydrates, sugars, and fats

Identify the chemical structure of nucleic acids and DNA, RNA