

Principles of Chemistry II, Chemistry 1220, Spring Semester 2022

Section 1, M W F, 8:30-9:20 AM, ESLC 130

Professor Scott A. Ensign, Office: Widtsoe 239, phone: 797-3969, email: scott.ensign@usu.edu

Office Hours:	Mon. and Wed., 1:00-2:30 PM, other times by appt.
Text:	On-line reference text: https://openstax.org/details/books/chemistry-2e We will cover chapters 12-21 of this open source (free) online textbook. If you would like a physical reference text, I recommend " <i>Chemistry: The Central Science</i> " Brown, Lemay & Bursten, any older edition (8 th - 14 th ed.) These older editions can be bought for a fraction of the cost of the current edition (typical cost will be 5-10 dollars) from on line vendors.
Prerequisite	Math 1050 or higher, Chemistry 1210
Course description	Chemistry 1220 is the second of a two-semester sequence of general chemistry for students in the physical and biological sciences and engineering. The course will cover topics presented in chapters 14-24 (12 th ed.) or chapters 14-25 (11 th and earlier ed.) of the Brown, Lemay and Bursten text.
Learning Management System	Canvas instructure will be used for the management of Chem. 1210. Importantly, <i>you will take your chapter quizzes on line using Canvas</i> . To log on to Canvas, go to the web address: canvas.usu.edu . Your USERNAME is your BANNER login and your default PASSWORD is your BANNER password. Canvas has many useful features (your assignment scores, a chat room, discussion page, mail, etc.) and you should take the time to explore them from within our course page. I will provide more instructions on using Canvas in class.
Lectures	Chemistry 1210 is a four-credit class, meaning there are four "50 minute" contact hours per week. Three of these contact hours are the MWF in-class lectures. Prior to Covid, students also met weekly in smaller recitation sections with teaching assistants (TAs) for the fourth contact hour. Due to expanding enrollment in the laboratory classes, the TAs previously assigned to recitations have now been assigned to laboratories, and recitations were eliminated. Due to this, the fourth weekly contact hour has now been switched to an out of class, on-line lecture to be watched on the Thursdays indicated on the syllabus. For the weeks where exams are given, there is no Thursday lecture. Use the class schedule to see the weeks where you will watch the out of class 50 minute lectures.
Class resources	My class resources, including chapter self tests, lecture overheads, lecture recordings, tutorials, recorded solutions, multimedia, practice exams, online textbook, and current exam keys are available from within canvas, or by using this external website http://ensignchemistry.com/chem2/ The username and password for accessing the resources from this website are ensigns and tadpoles2020 . Accessing and using my resources is essential for your success in chemistry 1210.
Supplemental Instruction And UTF	Supplemental instruction is provided for this class. Ethan Meredith (ethan.k.mere@gmail.com) is your SI instructor. The times and locations will be announced the first week of class and posted in canvas.

Chapter self tests (non-graded)	There will be an end of chapter (non-graded) self test consisting of ~40-50 questions for each chapter. You should work each question of the self tests as homework, according to the schedule on the “recordings” resource page, and watch my recorded solutions as necessary, in order to master the concepts from each chapter.
On line chapter quizzes (graded)	<p>There will be 10 chapter quizzes offered throughout the semester. Each quiz counts 10 points, is open book and consists of between 10 and 15 questions. You will take the quizzes on line through Canvas. You will have 60 minutes to take each quiz. You may repeat a given quiz up to four additional times during the availability period (indicated in Canvas) to improve your grade on that particular quiz. Your highest score for the five attempts will be recorded. Note that each time you take a quiz you will receive a slightly different version, covering the same concepts but with different questions. I encourage you to take each quiz the full five times, as the problem-solving skills you will gain from taking the quizzes multiple times will be very beneficial in preparing for the exams. The deadlines for completing all attempts of the quizzes are posted in canvas. It is your responsibility to make sure all quiz attempts are taken by the deadlines. Extensions of the quiz deadlines will only be made for documented illness or emergency and with advance notification to me ahead of the quiz deadline.</p> <p>A comprehensive make up quiz, offered at the end of the semester, will be offered to allow you to replace a missed or low quiz score. Your highest 10/11 quiz scores will count towards your grade.</p>
Week in review quizzes (graded)	<p>Multiple choice quizzes, consisting of 5 questions worth 1 point each, will be given on-line through Canvas at the conclusion of the weeks indicated on the class syllabus. These quizzes contain questions related to concepts covered in class for that week’s lectures. These quizzes are timed (30 minutes).</p> <p>For each of the “week in review” quizzes, you will be given the opportunity to retake the quiz a second time, if you wish, to improve your score on the quiz. The second attempt will become available after we discuss the quiz in class after the deadline for the first attempt has closed. During our discussion of the quiz, we will work through problems like the ones on the quiz that a sizable number of students struggled with, so you can make corrections as needed. The second attempt will then become available for you to take at the conclusion of class and will be due at the end of that lecture day at midnight.</p>
Iclickers (in-class extra credit)	USU has adopted a universal, campus wide interactive “personal response system” for classroom use called the “iclicker”. You can either purchase a physical iclicker (bookstore, amazon, friend, etc) or purchase a subscription for the iclicker app that works on your phone. The iclicker will be used for lecture participation, assessment, and student feedback. Please have your iclicker registered before Friday, January 15 . To register your iclicker, <i>use the link located in the navigation bar in our course in canvas instructure page</i> . Even if you registered your iclicker for a previous semester, you must re-register it for the spring semester in our course page.
Midterm Exams (graded)	Three midterm exams (100 points each) will be given from within canvas at the USU testing center during a two-day availability period. The exams are based on material covered in class and closely match the difficulty level and content of the practice exams, chapter self-tests, and graded online quizzes. You are strongly encouraged to work the on-line chapter self-tests, take the quizzes the full five times, and work the practice exams posted in canvas and given in previous years as part of your exam preparation.

Midterm exam second chance (retake) to raises your midterm score (exam extra credit)	After the exam availability window closes, and after detailed exam results are released, you will have two days to "retake" the exam on your own computer in an open book format to increase your exam score. About 25% of the questions on the "retake" exam will be identical, and the remainder will test the same concepts as on the questions from your midterm but with changes in numbers, wording, etc. I recommend printing out your exam results ahead of the exam retake, and reworking any questions you missed, so you can get the corresponding questions right when you complete the retake exam. The purpose of the retake exercise is to allow you to correct errors/mistakes you made on the original exam, and get the questions right on your second attempt. The point value for the exam retake will be determined by the class average on the exam. If the exam average is 73% or higher, the exam retake will be worth a maximum of two points added to your original exam score. If the exam average is less than 73%, the retake will be worth "75 minus the exam average". The points you receive on the retake will be added to your original exam score to increase your exam score by that number. For example, if the average on exam 1 is 67%, the retake will be worth $(75 - 67) = 8$ points total. If your original score was 74/100 (74%), and you retake the exam and score 93.75% (7.5/8), the 7.5 points will be added to your original score giving you 81.5/100. If you score 100/100 and retake the exam and score 100% (8/8), your score will be adjusted to 108/100.
On-line make-up exam (can substitute for lowest midterm score)	An optional "make-up exam", covering all the material covered on midterms 1-3 and worth 100 points, will be offered officially during week 14. The exam may also be taken during no test week (week 15) if you choose to take it then. Note there is no "retake" option for the make-up exam. Instead, I will take the average of the extra credit you earn for the retakes for exams 1-3 and add this point value to your score on the make-up exam that counts in the gradebook. If you score <i>higher</i> on the adjusted exam score for the make up exam than on your lowest of three midterms, the score will replace the lowest midterm score. If you score <i>lower</i> on the make-up exam than on all three of your in-class midterms, then this exam score will not count. The make-up exam is to be taken in the USU testing center. More information about the make-up exam will be provided in class and in Canvas.
Final exam	The final exam (200 points) will be given in the USU testing center during finals week. The final exam will consist of a "new material" section (material covered since exam 3) and a "comprehensive portion" (material covered on exams 1-3).
Missed exams and recitation quizzes	If you miss one of the three in-class midterms due to illness or emergency, I will offer you the opportunity to take an exam covering the same material to substitute for the missed exam. If possible, I should be notified of the absence and reason <u>before</u> the scheduled midterm or quiz. Missed exams or quizzes may require written documentation from a doctor or other authority at my discretion.

Grading	<p>A total of 650 points are possible in Chem. 1220 and are distributed as follows:</p> <p>Total of 3 midterms, or best two midterms and the on-line make-up exam..... 300 pts. Best 10 of 11 on-line quizzes @ 10 points each 100 pts. Comprehensive Final Exam (F, May 6, 7:30-9:20 AM, ESLC130) 200 pts. Best 10 of 11 Week in review quizzes @5 pts each 50 pts. ----- Total points..... 650 points</p> <p>In addition, to encourage you to attend, prepare for, and be attentive during lectures, you may earn up to 8 points extra credit based on correct responses to the questions I will ask in lectures using the iclicker system. Iclicker extra credit points.....8 points</p> <p>In terms of final assignment of grades, you are <i>guaranteed</i> the following grades if your final class percentage lies within the indicated ranges:</p> <table border="0"> <tr> <td>A/A-</td> <td>100 to 88.00% (93.00 % or above is a guaranteed straight “A”)</td> </tr> <tr> <td>B+/B/B-</td> <td><88.00 to 77.00%</td> </tr> <tr> <td>C+/C/C-</td> <td><77.00 to 60.00%</td> </tr> <tr> <td>D+/D</td> <td><60.00 to 50.00%</td> </tr> </table> <p>Based on the overall class average, the percentage cuts for the various grades may shift lower than the above cuts. In other words, better grade may be assigned for <u>lower</u> percentages than those indicated above, a scenario that is <i>to your favor</i>. However, the percentages will <u>never shift higher</u> than the above, so you are assured the indicated or a higher grade, depending on the class average at the conclusion of the course. In general, in order for grade breaks to be dropped lower than those indicated above, the overall class average on all assignments would be below 75%.</p>	A/A-	100 to 88.00% (93.00 % or above is a guaranteed straight “A”)	B+/B/B-	<88.00 to 77.00%	C+/C/C-	<77.00 to 60.00%	D+/D	<60.00 to 50.00%
A/A-	100 to 88.00% (93.00 % or above is a guaranteed straight “A”)								
B+/B/B-	<88.00 to 77.00%								
C+/C/C-	<77.00 to 60.00%								
D+/D	<60.00 to 50.00%								
Course Withdrawal:	<p>Withdrawal from the course after January 31 will result in a “W” notation being placed on your transcript. No withdrawal is permitted after March 23.</p>								
Provisions:	<p>The administration of Chem 1220 will adhere strictly to the academic policies outlined in the most recent USU General Catalog, which can be found here: http://catalog.usu.edu/content.php?catoid=12&navoid=3139</p>								
Course assessment	<p>Students in this class are expected to develop proficiency in the principles listed on the class schedule and the attached “Learning Objectives” list. Questions provided on midterms, quizzes, and through the use of the iclicker personal response system will be used to assess your understanding of these principles. The formats to be used for assessment will include instructor-designed questions. Please note that assessment is a tool used by the Department of Chemistry and Biochemistry to improve the quality of instruction and proficiency of our students. Your grade will be based on your performance on the assignments indicated above, some of which will be used for course assessment.</p>								

In accordance with the Americans with Disabilities Act, reasonable accommodations will be provided for all persons with disabilities in order to ensure equal participation in Chem 1220. In cooperation with the Disability Resource Center, reasonable accommodation will be provided for students with disabilities. Please meet with the instructor during the first week of class to make arrangements. Alternative format print materials, large print, audio, diskette or Braille, will be available through the Disability Resource Center.

Chemistry 1220 Learning objectives

- Describe reaction rates in terms of zero, 1st, 2nd, 3rd order processes
- Describe reaction rates as a function of temperature
- Predict reaction half-lives given initial conditions
- Differentiate between the plots of 1st order and 2nd order reactions
- Describe the action of catalysis on a chemical reaction
- Describe reactions in terms of elementary steps and rate-determining steps
- 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
- 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
- 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
- Describe and apply concepts of chemical spontaneity and the 2nd Law of Thermodynamics - - -
- Describe and apply the concepts of entropy to chemical reactions
- Use Gibb's Free Energy to predict chemical equilibrium
- 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 in use today -
- Describe the chemical reactions of corrosion
- Describe and differentiate between fundamental types of radioactivity and radioactive processes - Predict nuclear stability based on proton/neutron ratios
- Apply 1st order kinetics for radioactive decay
- Compare the energetic and mass aspects of nuclear fission and nuclear fusion
- Describe the fundamental aspects of the reactivity of non-metal elements
- Identify the major chemical processes for purifying iron, steel, aluminum, copper, and sodium
- - 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
- Identify and draw the structure of hydrocarbon alkanes, alkenes, alkynes, and aromatics
- Identify and draw the organic functional groups ethers, aldehydes, ketones, acids, esters, and amides

Week	Day	Date	Lecture	Section	Text chapter†	Week in review quiz	Chapter quiz (5 attempts)	Exam		
1 (1/10)	M	1/10	1	Course introduction, syllabus	14(BLB) 12(OS)					
	W	1/12	2	1. Kinetics						
	R*	1/13	3	1. Kinetics						
	F	1/14	4	1. Kinetics (iclicker use starts)					1 (due 1/18)	
2 (1/17)	M	1/17		Martin Luther King Jr. day : no class						
	W	1/19	5	1. Kinetics					1 (due 1/29)	
	R*	1/20	6	1. Kinetics, 2. Equilibrium					15 (BLB) 13 (OS)	2 (due 1/23)
	F	1/21	7	2. Equilibrium						
3 (1/24)	M	1/24	8	2. Equilibrium						
	W	1/26	9	2. Equilibrium					2 (due 2/4)	
	R*	1/27	10	2. Equilibrium					16 (BLB) 14 (OS)	3 (due 1/30)
	F	1/28	11	3. Acid-base equilibrium						
4 (1/31)	M	1/31	12	3. Acid-base equilibrium						
	W	2/2	13	3. Acid-base equilibrium					3 (due 2/11)	
	R*	2/3	14	3. Acid-base equilibrium						
	F	2/4		Help session in-class (optional)						
5 (2/7)	M	2/7	15	4. More aqueous equilibrium	17 (BLB) 14 (OS) and 15 (OS)					
	W	2/9	16	4. More aqueous equilibrium						
	R*	2/10	17	4. More aqueous equilibrium					4 (due 2/14)	
	F	2/11	18	4. More aqueous equilibrium						
6 (2/14)	M	2/14	19	4. More aqueous equilibrium	19 (BLB)					
	W	2/16	20	4. More aqueous equilibrium					4 (due 2/25)	
	R*	2/17	21	5. Thermodynamics					5 (due 2/20)	
	F	2/18	22	5. Thermodynamics						
7 (2/21)	M	2/21		Presidents day- No class						
	W	2/23	23	5. Thermodynamics						
	R*	2/24	24	5. Thermodynamics					6 (due 2/27)	5 (due 3/18)
	F	2/25	25	5. Thermodynamics						
8 (2/28)	M	2/28	26	5. Thermodynamics						
	W	3/2	27	Catch up, prepare for exam 2						
	R*	3/3		no on-line lecture this week					2, sec. 4-5: 3/2-3/4	
	F	3/4		No class						
9 (3/14)	M	3/14	28	6. Electrochemistry	20(BLB) 17(OS)					
	W	3/16	29	6. Electrochemistry						
	R*	3/17	30	6. Electrochemistry					7 (due 3/20)	
	F	3/18	31	6. Electrochemistry						
10 (3/21)	M	3/21	32	6. Electrochemistry	21(BLB) 21(OS)					
	W	3/23	33	6. Electrochemistry					6 (due 4/1)	
	R*	3/24	34	7. Nuclear chemistry					8 (due 3/27)	
	F	3/25	35	7. Nuclear chemistry						
11 (3/28)	M	3/28	36	7. Nuclear chemistry	22(BLB) 18(OS)					
	W	3/30	37	7. Nuclear chemistry					7 (due 4/8)	
	R*	3/31	38	8. Non-metals					9 (due 4/3)	8 (due 4/8)
	F	4/1	39	8. Non-metals						
12 (4/4)	M	4/4	40	8. Non-metals						
	W	4/5		Help session in-class (optional)						
	R*	4/6		no on-line lecture this week					3, sec. 6-8: 4/4-4/6	
	F	4/8	41	9. Metals & Coordination Chemistry 23&24 (BLB),						
13 (4/11)	M	4/11	42	9. Metals & Coordination Chemistry 19(OS)						
	W	4/13	43	9. Metals & Coordination Chemistry					9 (due 4/22)	comp. make up exam: due 4/27
	R*	4/14	44	9. Metals & Coordination Chemistry					10 (due 4/17)	
	F	4/15	45	10. Organic Chemistry						25(BLB) 20(OS)
14 (4/18)	M	4/18	46	10. Organic Chemistry						
	W	4/20	47	10. Organic Chemistry					10 (due 5/3)	
	R*	4/21	48	10. Organic Chemistry					11 (due 4/24)	
	F	4/22	49	Review for final exam						
15 (4/25)	M	4/25	50	Review for final exam						

Final Exam, available April 28-May 4 in the testing center

* The indicated Tuesday OR Thursday lectures for these weeks are on-line, and are to be watched prior to the next in-class lecture

† Three text options are older edition (9th-11th) of Brown Lemay Bursten (BLB), or free on-line openstax text (OS).