Principles of Chemistry 1, Chemistry 1210, Fall 2021

Sections 1 and 3, ESLC130

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Office Hours:	In my office: Mon. and Wed., 1:00-2:30 PM, other times by appt. Please use the following link to access my office hours on-line: https://usu-edu.zoom.us/j/8567161245?pwd=SUtOc0xkbDhuV0MydHl1UEhlRG0xZz09
Text:	Dr. Ensign's on-line textbook: http://ensignchemistry.com/chem1/textbook.html username: ensigns password tadpoles2020 **or** Openstax textbook: https://openstax.org/details/books/chemistry-2e **or:** Any older print edition (~$10-20) of Brown Lemay Bursten, Chemistry, the Central Science 12th edition, 0321696727; 11th edition, 0136006175; 10th edition, 0131096869; 9th edition, 0130669970.
Prerequisite	Previous or concurrent enrollment in Math 1050 or higher
Course description	Chemistry 1210 is the first 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 the first half of a typical general chemistry text. Chemistry 1220 will cover the remainder of the material in the text.
Learning Management System	Canvas instructure will be used for the management of Chem. 1210. Importantly, *you will take your chapter quizzes and exams on line using Canvas.* I will also post *important announcements* in Canvas, all of which should be read. To log on to Canvas, go to the web address: https://usu.instructure.com/login/canvas Your **USERNAME** is your BANNER login and your default **PASSWORD** is your BANNER password. Canvas has many useful features (your assignment scores, zoom portal, 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 the introductory lecture.
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/chem1/ 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	Emily Hull (emilyannehull@gmail.com), Ethan Meredith (ethan.k.mere@gmail.com) and Em Haroldsen (emharoldsen@gmail.com) will be the SI instructors for this course. The SI times and locations will be posted on our Canvas main page. Mike Deming (mike.deming@hotmail.com), Kami Morgan (kamimorgan13@gmail.com) and Ethan Harris (aggie.harris.etru@gmail.com) have been assigned as undergraduate teaching fellows (UTF) for this class. They will hold weekly online office hours to provide personal help and tutoring. The times will be posted in canvas.
Chapter self tests (non-graded)	There will be an end of chapter (non-graded) self-test (practice problems) consisting of ~40-50 questions for each chapter. I provide both written and recorded solutions (tutorials) to these self-tests. You should work each question of the self-tests as homework, and watch my recorded solutions as necessary, to master the concepts from each chapter.
On-line Chapter Quizzes (graded)	There will be 12 graded on-line quizzes offered throughout the semester. Each quiz counts 10 points and is open book. You will take the quizzes online through Canvas. Quizzes are to be taken during the availability periods indicated on the class schedule and within canvas. Quizzes will usually consist of 10 questions, worth 1 point each. You will have 60 minutes to take each quiz. You may repeat a given quiz up to four additional times to improve your grade on that particular quiz, if you wish. 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. Remember, there is no penalty for repeating a quiz; your highest score of all attempts is the one that will be entered into the gradebook. The quiz deadlines will be posted in Canvas and you should make note of them. All attempts of a quiz must be taken by the quiz deadline.
Week in review quizzes (graded)	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) and may be taken only once.
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. If you will be taking other USU courses using the iclicker, you will probably want to keep your clicker beyond this semester (you may already have one for another course). The iclicker will be used for lecture participation, assessment, and student feedback. Please have your iclicker registered before **Friday, September 3.** To register your iclicker, *use the link located in the navigation bar in our course in canvas instructure page*. **Even if you registered your iclicker for a previous semester, you must re-register it for the fall semester in our course page.**

Midterm Exams (graded) best 3 of 4	Four 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. Your best three of four midterm exam scores will count towards your final grade.
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.
Final exam	The comprehensive final exam (200 points) will be given in the USU testing center. The exam may be taken anytime during finals week. The final exam will consist of both a "new material" section (100 points, material covered since exam 4) and a "comprehensive portion" (100 points, material covered on exams 1-4).
Missed exams	If you miss one of the four midterm exams 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 at all possible, I should be notified of the absence and reason before the scheduled midterm. Missed exams may require written documentation from a doctor or other authority at my discretion.

Grading

A total of 670 points are possible in Chem. 1210 and are distributed as follows:

Best 3 of 4 midterm exams ..... 300 pts.
12 on-line chapter quizzes @ 10 points each ..... 120 pts.
10 "week in review" quizzes @ 5 points each ..... 50pts.

Comprehensive Final Exam ..... 200 pts.

Total points..... 670 points

In addition, to encourage you to attend, prepare for, and be attentive during lectures, you **may earn up to 8 points of additional extra credit** based on correct responses to the questions I will ask in lectures using the iclicker system.

extra credit points) **.....8 points**

In terms of final assignment of grades, you are *guaranteed* the following grades if your final class percentage lies within the indicated ranges:

Name:	Range:	
A	100 %	to 93.0%
A-	< 93.0 %	to 88.0%
B+	< 88.0 %	to 85.0%
B	< 85.0 %	to 81.0%
B-	< 81.0 %	to 77.0%
C+	< 77.0 %	to 73.0%
C	< 73.0 %	to 66.0%
C-	< 66.0 %	to 60.0%
D+	< 60.0 %	to 56.0%
D	< 56.0 %	to 50.0%
F	< 50.0 %	to 0.0%

This is the grading scheme currently set in Canvas with the guaranteed breaks. Note that percentages **DO NOT ROUND** to these values: for example, a 92.99% average will **not** round to 93.0, and will result in an "A-" grade. To earn an "A", your average must be 93.00% or better. If the overall class average on all assignments at the conclusion of the semester is less than 73%, the **percentage cuts for the various grades may shift lower than the breaks shown at left.** In other words, better grade may be assigned for lower percentages than those indicated above, a scenario that is *to your favor,* but only if the overall class average on all assignments is 73% or less. Grade breaks will not be shifted based on individual student petitions.

Course Withdrawal:

Withdrawal from the course after Sept. 20 will result in a "W" notation being placed on your transcript. No withdrawal is permitted after Nov. 1.

Provisions:

The administration of Chem 1210 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

Course assessment

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.

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 1210. 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.

Week	Day	Date	Lecture	Section	Text chapter†	Week in review quiz	Chapter quiz (5 attempts)	Exam
1 (8/30)	M	8/30	1	Course introduction, syllabus	1 (Ensign, BLB)			
	W	9/1	2	1.matter and measurements				
	R*	9/2	3	1. matter and measurements				
	F	9/3	4	1, 2 (iclicker use starts)	2 (Ensign, BLB)	1 (due 9/7)		
2 (9/6)	M	9/6		Labor day: no class			1 (due 9/15)	
	W	9/8	5	2. atomic structure				
	R*	9/9	6	2. atomic structure				
	F	9/10	7	2. atomic structure		2 (due 9/12)		
3 (9/13)	M	9/13	8	2. atomic structure			2 (due 9/22)	
	W	9/15	9	3. stoichiometry and calculations	3 (Ensign, BLB)			
	R*	9/16	10	3. stoichiometry and calculations				
	F	9/17	11	3. stoichiometry and calculations		3 (due 9/19)	3 (due 9/29)	
4 (9/20)	M	9/20	12	3. stoichiometry and calculations				
	W	9/22	13	Review for exam 1				**1, sec. 1-3, 9/22-23**
				no on-line lecture this week				
	F	9/24	14	4. Aqueous reactions	4 (Ensign, BLB)			
5 (9/27)	M	9/27	15	4. Aqueous reactions				
	W	9/29	16	4. Aqueous reactions				
	R*	9/30	17	4. Aqueous reactions			4 (due 10/6)	
	F	10/1	18	5. thermodynamics	5 (Ensign, BLB)	4 (due 10/3)		
6 (10/4)	M	10/4	19	5. thermodynamics				
	W	10/6	20	5. thermodynamics				
	R*	10/7	21	5. thermodynamics			5 (due 10/13)	
	F	10/8	22	Review for exam 2		5 (due 10/10)		
7 (10/11)	M	10/11	23	6. electronic structure	6 (Ensign, BLB)			**2, sec. 4-5, 10/11-12**
	W	10/13	24	6. electronic structure				
				no on-line lecture this week				
	F	10/15		Fall break: no class				
8 (10/18)	M	10/18	25	6. electronic structure				
	W	10/20	26	6. electronic structure				
	R*	10/21	27	6. electronic structure			6 (due 10/27)	
	F	10/22	28	7. periodic properties	7 (Ensign, BLB)	6 (due 10/24)		
9 (10/25)	M	10/25	29	7. periodic properties			7 (due 11/3)	
	W	10/27	30	Review for exam 3				
		10/28		no on-line lecture this week				**3. sec. 6-7. 10/27-28**
	F	10/29	31	8. chemical bonding	8 (Ensign, BLB)			
10 (11/1)	M	11/1	32	8. chemical bonding				
	W	11/3	33	8. chemical bonding				
	R*	11/4	34	8. chemical bonding				
	F	11/5	35	8. chemical bonding		7 (due 11/7)	8 (due 11/17)	
11 (11/8)	M	11/8	36	9. bonding theories	9 (Ensign, BLB)			
	W	11/10	37	9. bonding theories				
	R*	11/11	38	9. bonding theories				
	F	11/12	39	9. bonding theories		8 (due 11/14)		
12 (11/15)	M	11/15	40	9. bonding theories			9 (due 11/24)	
	W	11/17	41	Review for exam 3				**4. sec. 8-9, 11/17-18**
				no on-line lecture this week				
	F	11/19	42	10. gases	10 (BLB); 9 (OS)			
13 (11/22)	M	11/22	43	10. gases				
	W			holiday- no class				
	R*			holiday- no class				
	F			holiday- no class				
14 (11/29)	M	11/29	44	10. gases			10 (due 12/8)	
	W	12/1	45	11. liquids and solids	11 (BLB); 10 (OS)			
	R*	12/2	46	11. liquids and solids				
	F	12/3	47	11. liquids and solids		9 (due 12/5)	11 (due 12/15)	
15 (12/6)	M	12/6	48	12. solution properties	12 (BLB); 11 (OS)			
	W	12/8	49	12. solution properties				
	R*	12/9	50	12. solution properties			12 (due 12/17)	
	F	12/10		Review for final exam		10 (due 12/12)		
16 (12/13)	**Final Exam, available M-F of finals week in the testing center**							

* Thursday lectures are on-line, and are to be watched prior to Friday's lecture

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

Chemistry 1210 Learning objectives

Define matter and classify it from the level of mixtures and compounds to elements

Differentiate physical and chemical properties and changes and intensive and extensive properties.

List and define the base S.I. units of mass, length, time, temperature and amount of a substance, and manipulate the base units to give derived SI units

Use the principles of dimensional analysis and conversion factors to convert quantities expressed in one unit to another unit.

Express numbers in different units by using the prefix and exponential notation methods.

Explain the difference between precision and accuracy, and relate these terms to the concept and usage of significant figures in experimental measurements.

Explain the atomic theory of matter, emphasizing the composition of the atom, and what defines the identity of a given element.

Explain the relative sizes, masses, and charges of the proton, neutron, and electron, and how they assemble to form an atom.

Define the term isotope, and be able to discern the subatomic composition of an atom given its atomic and mass numbers. Represent the atom using the element symbol with superscript and subscript denoting the composition.

Use the Periodic Table to rationalize similarities and differences of elements, including physical and chemical properties and reactivity. Predict common ion charges of group 1A, 2A, 3A, 6A, and 7A elements based on position in the periodic table.

Name and predict ions formed from the elements, and recognize and be able to name common polyatomic cations and anions.

Differentiate between ionic and molecular compounds, and empirical and molecular formulas

Given the chemical formula for an ionic compound or molecule, provide a proper unambiguous systematic name for the compound. Conversely, given the compound name, write the single chemical formula that matches the name.

Given the reactants and products for a chemical equation, balance the equation using whole number coefficients.

Recognize the following common chemical reactions: combustion, decomposition, combination.

Given the atomic weights and relative abundances of naturally occurring isotopes, calculate the average atomic weight of an element.

Use average atomic weights from the Periodic Table to calculate formula weights and molecular weights for compounds.

Use the concepts of the mol, molar mass and Avogadro's number and conversion factors derived from their relationships to interconvert between mass, mols, and numbers of particles for atoms and molecules.

Explain the basis for the "mass defect" seen when an experimentally determined molar mass for an atom is compared to the sums of the masses of the subatomic particles in that atom.

Use the stoichiometric relationships between atoms in molecules, and the stoichiometric coefficients on reactants and products in chemical reactions, to interconvert between numbers of particles, mols, and masses within compounds and for chemical changes.

Given the molar mass of an unknown compound and it's elemental composition in mass percent, determine the empirical and molecular formulas for the compound.

Given a chemical reaction and masses of reactants, determine the limiting reagent if the reaction goes to completion, and calculate the masses of products formed and excess reagent remaining at the conclusion of the reaction.

Understand solution composition and the terms solvent and solute

Differentiate between weak and strong electroytes and nonelectrolytes

Define and differentiate strong and weak acids and bases

Define "solubility" and "miscibility" and understand the factors that make a solute soluble in water

Define and write representative equations for aqueous reactions involving neutralization, precipitation, gas generation, and oxidation/reduction.

Define and write representative equations for molecular equations, complete ionic equations, net ionic equations.

Recognize spectator ions in aqueous reactions

Define solution concentration in units of molarity and use dimensional analysis to interconvert molarity, mass, mols, and volume.

Define energy in terms of work and radiation (heat), and differentiate the following types of energy and the terms that relate to it: kinetic, potential, thermal, chemical energy; conservation of mass, system and surroundings, state function

Describe energies, energy changes and associated signs referenced relative to the system of interest

Define enthalpy and exothermic and endothermic reactions

Determine the enthalpy for a reaction given information from a standard table of enthalpies of formation or using specific heat and calorimetry data

Apply Hess' law to determine enthalpies of reaction

Describe the properties of electromagnetic radiation, and use the appropriate equations that interrelate energy, frequency, wavelength, Planck's constant, and the speed of light

Explain the concept of "photons" and "quanta" and the dual nature of radiant energy

Explain the Bohr model of the hydrogen atom and use the Rydberg equation to determine the energies associated with electronic transitions

Explain the dual nature of matter (wave and particle).

Explain how the Heisenberg uncertainty principle and Schrodinger models relate to electronic structure

Describe electronic structure in terms of orbitals, with associated quantum numbers n, l, m_l, and m_s and how these quantum numbers relate to the energies, shapes, orientations, and spins of electrons in atoms

Use the above principles of quantum chemistry together with the Pauli exclusion principle and Hunds rule to predict the electronic configurations of multielectron atoms

Predict periodic properties, including relative sizes of atoms, ionization energies, and electron affinities using the principles outlined in class

Understand and describe chemical bonding at the level presented in class, with particular emphasis on understanding and applying the following terms/concepts: Lewis symbols and atoms, Ionic bonding, Lattice energy, isoelectronic series, covalent bonding, electronegativity and bond polarity, Lewis structures, formal charges, resonance, octet violations, bond strengths, oxidation numbers

Apply valence shell electron pair repulsion theory to properly-drawn Lewis structures to predict bond angles and geometries about atoms in molecules

Use valence bond theory to describe covalent bonding in terms of orbital overlaps and hybridizations

Describe the properties of a gas in terms of the variables P, V, n, and T

Use the Ideal gas law to interconvert between P, V, n, and T for a gas

Understand and explain Kinetic-molecular theory

Explain the factors that lead to non ideal behavior for a gas

Understand and identify the intermolecular forces important in different solids and liquids

Describe the processes by which states of matter are changed

Define vapor pressure and boiling point

Interpret heating curves and phase diagrams for a compound

Understand the solution process in terms of thermodynamics

Explain the factors that affect solubility of a solute

Understand and explain the different colligative properties and use the proper mathematical equations to quantitatively describe these effects