Principles of Chemistry, Chemistry 1210, Spring 2006

Section 1, M W F, 10:30-11:20 AM, BNR 102

Professor Scott A. Ensign, Widtsoe 239, 797-3969, ensigns@cc.usu.edu,
www.chem.usu.edu/~ensigns

Office Hours: Tue.and Thurs. 10:30 – 11:30 AM, Wed. 12:30-1:30 PM, other times by appt.

Text: "*Chemistry: The Central Science*" 10th ed., 2006; Brown, Lemay & Bursten. A previous edition of this text (7th, 8th or 9th ed.) will work just fine if you can find one.

Prerequisite 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 13 chapters of the Brown, Lemay and Bursten text. Chemistry 1220 will cover the remainder of the material in the text.

Recitation All students must register for a section of recitation listed in the course schedule. Recitation sections consist of groups of about 30 students and are administered by teaching assistants. **One sixth (1/6) of the Chem 1210 grade** is derived from performance in recitation (quizzes and participation). The recitation setting is designed to develop problem solving skills needed for the class examinations. **Recitation sections will begin during the second week of classes.**

WebCT I will be using WebCT (Web Course Tools) for the management of Chem. 1210. All reserve materials, including my lecture overheads, lecture recordings, the syllabus, class schedule, practice problems, current exam keys, previous exams and keys, solutions to the problems in the text, and updated grade sheets, will be available through WebCT. The reserve materials will be provided to you as downloadable PDF files, which require AcrobatReader, a free program available for both PC and mac platforms at the Adobe web site. To access WebCT, go to the address **webct.usu.edu.** Logon to WebCT as follows: Your **USERNAME** is your BANNER login and your default **PASSWORD** is your BANNER password. The class ID is **CHEM1210_SE**. WebCT has many useful features (your assignment scores, a chat room, bulletin board, e-mail, etc.) and you should take the time to explore them from within our course page. I will provide more instructions on using WebCT in class.

Lecture Overheads and recordings Copies of my lecture overheads will be posted on WebCT. I recommend downloading and printing the appropriate overheads before lecture and using them to take your notes in class. Lectures will be recorded and provided in both Macromedia Breeze (sound with overheads) and mp3 (sound only) formats.

Resource Room and Supplemental Instruction A Resource Room will be available for all students taking general chemistry. The times and location of this service will be posted on the course homepage on WebCT. Supplemental instruction (S.I.) will also be provided for this course. Your S.I. instructor is Justin Mecham (justinmecham@cc.usu.edu). The S.I. times and locations will be posted on our webCT page.

Exams Three hourly exams (100 points each) will be given during class on the dates

indicated on the course schedule. The final exam is in-class and counts 200 points (80 points on material presented since exam 3; 120 points comprehensive). The multiple choice exams are based on material covered in class. You are strongly encouraged to read the text chapters, work the practice problems in the text, and work the practice exams I have placed on reserve. Your performance ultimately depends on your proficiency under testing conditions.

Missed exams Anyone missing one of the hour exams for legitimate reasons will be eligible to take the make-up exam offered on April 21 by appointment only. This exam will be comprehensive through the material covered in the first twelve weeks of the course. This is the only make-up exam that will be offered. Missed exams that are not made-up will be scored as zero.

Grading A total of 600 points are possible in Chem. 1210 and are distributed as follows:

1st Hour Exam (F, Feb. 10, 10:30 AM, BNR 102)	100 pts.
2nd Hour Exam (W, March 8, 10:30 AM, BNR 102)	100 pts.
3rd Hour Exam (F, April 14, 10:30 AM, BNR 102)	100 pts.
10 of 11 Recitation quizzes @ 10 points each	100 pts.
Comprehensive Final Exam (W, May 3, 9:30-11:20 AM, BNR102)	200 pts.
Total points	600 points

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

A/A-	88-100%
B-/B/B+	77-87%
C-/C/C+	60-76%
D-/D/D+	50-59%

Based on the overall class average, the percentage cuts for the various grades may shift lower than the above cuts. In other words, an "A" grade may be assigned for <u>lower</u> percentages (e.g. 86-100%) than those indicated above, a scenario that is *to your favor.* 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.

Course Withdrawal: Withdrawal from the course after Jan. 30 will result in a "W" notation being placed on your transcript. No withdrawal is permitted after March 31.

Provisions: The administration of Chem 1210 will adhere strictly to the regulations outlined in the Fall Semester Schedule of Classes, pp. 104-109. Missed exams or quizzes may require written documentation from a doctor, parent or other suitable authority, at my discretion.

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	Topic	Chapter	Recitation
1	M	1/9	1	Matter, Elements and Compounds	1	no quiz or recitation this week
	W	1/11	2	Measurements	1	
	F	1/13	3	Atomic Structure	2	
2	M	1/16		Holiday: Martin Luther King Jr. Day		recitations meet, except M section
	W	1/18	4	Periodic Table	2	
	F	1/20	5	Nomenclature	2	
3	M	1/23	6	Balancing Equations	3	**Quiz 1**
	W	1/25	7	Atomic/Molecular Wts.	3	
	F	1/27	8	Empirical Formulas	3	
4	M	1/30	9	Calc. on Chem. Equations *(drop deadline w/o "W")*	3	**Quiz 2**
	W	2/1	10	Molarity, Electrolytes	4	
	F	2/3	11	Acid, Base, Salts and Ions	4	
5	M	2/6	12	Metals	4	**Quiz 3**
	W	2/8	13	Review for Exam 1		
	F	2/10		**Exam 1 (Chapters 1-4)**		
6	M	2/13	14	Energy, First Law	5	**Quiz 4**
	W	2/15	15	Enthalpy, Hess's Law	5	
	F	2/17	16	Enthalpy of Formation	5	
7	M	2/20	no class-Pres. Day- meet tomorrow (Tuesday) instead			M recitation meets on T; T recitation does not meet
	T	2/21	17	Radiant Energy (NOTE TUESDAY DATE!!)	6	
	W	2/22	18	Quantum Effects	6	
	F	2/24	19	Bohr Atom, Orbital	6	
8	M	2/27	20	Many Electron Systems	6	**Quiz 5**
	W	3/1	21	Atomic sizes, energies	7	
	F	3/3	22	Electron Ionization, Affinity	7	
9	M	3/6	23	Review for Exam 2		**Quiz 6**
	W	3/8		**Exam 2 (Chapters 5-7)**		
	F	3/10	24	Lewis Structures	8	
	M	3/13				
	W	3/15		No class, spring break		
	F	3/17				
10	M	3/20	25	Covalent Bonds	8	**Quiz 7**
	W	3/22	26	Resonance, Octet violations	8	
	F	3/24	27	Bond Energies	8	
11	M	3/27	28	Oxidation number	8	**Quiz 8**
	W	3/29	29	VSEPR theory	9	
	F	3/31	30	Bond polarity	9	
12	M	4/3	31	Hybrid orbitals	9	**Quiz 9**
	W	4/5	32	Gases	10	
	F	4/7	33	Gas laws	10	
13	M	4/10	34	Partial pressures	10	**Quiz 10**
	W	4/12	35	Review for Exam 3		
	F	4/14		**Exam 3 (Chapters 8-10)**		
14	M	4/17	36	Liquids and Solids	11	**Quiz 11**
	W	4/19	37	Liquids and Solids	11	
	F	4/21	38	Solution Properties	13	
15	M	4/24	39	Solution Properties	13	
	W	4/26	40	Solution Properties	13	
	F	4/28	41	Review for final examination		
	W	5/3		**Final Exam (Lectures 1-39) 9:30 - 11:20 AM**		

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 coefifficients 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