Principles of Chemistry Chem 1210, Spring 2018

Section 1, # 11019, MWF, 10:30-11:20 AM, BNR 102
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Office Hours: M & W, 1:30 PM-2:30 PM; other times by appointment.

Text: "*Chemistry: The Central Science*" 13th ed., 2015; Brown, Lemay, Bursten & Murphy, Woodward, and Stoltzfus.

Prerequisites: High school algebra; elementary chemistry experience is highly recommended.

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. 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.**

Supplemental instruction (S.I.) will also be provided for this course. Your S.I. instructor is Thomas Burton (thomas.ja.burton@gmail.com). The S.I. times and locations: MWF 10:30 CHEM 1210 (Intro) Biology/NR 102.

Canvas Canvas will be used for the management of Chem 1210. Materials such as syllabus, current exam keys, practice exams will be posted on the Canvas.

Resource Room: A Resource Room will be available for all students taking general chemistry. The times and location of this service will be announced during the first week of classes.

Grading: A total of 770 points are possible in Chem. 1210 and are distributed as follows:

1st Hour Exam (W, February 7, 10:30 – 11-20 AM, BNR 102).....100 pts.
2nd Hour Exam (W, March 14, 10:30 – 11-20 AM, BNR 102).....100 pts.
3rd Hour Exam (F, April 13, 10:30 – 11-20 AM, BNR 102).....100 pts.
Participation in recitations……...60 pts.
Comprehensive Final Exam (W, May 2, 11:30 am – 1.20 pm, BNR102).....200 pts.

Total 560 pts.

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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 lower percentages (e.g. 86-100%) than those indicated above, a scenario that is to your favor. However, the percentages will never shift higher than the above, so you are assured the indicated or a higher grade, depending on the class average at the conclusion of the course.

Midterm exams and final exam:

The exams are multiple-choice exams, to be taken in class, the scantrons will be provided by the instructor. The students are to bring the calculators and #2 pencil to the exam.

Participation in recitations:

The students need to register and attend one of the recitation sections complimentary to this course. The participation in each recitation is worth 5 points to result in a total of 60 points of the final grade.

Missed Exams: Anyone missing one of the hour exams for legitimate reasons will be eligible to take the make-up exam offered on April 20 by appointment only. You must contact me either before or just after the missed exam to arrange to take the make-up exam. 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.

Provisions: The administration of Chem 1210 will adhere strictly to the regulations outlined in the Spring Semester Schedule of Classes 2018. Missed exams or quizzes require written documentation from a doctor, parent or other suitable authority.

Course Content: The course will cover topics presented in the first 13 chapters of the Brown, Lemay, Bursten, Murphy, Woodward, and Stoltzfus text. On the following page is a tentative outline of the topics to be covered in the MWF 10:30 AM class meetings. 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.

Course Withdrawal: January 30 - March 22: course withdrawals show as *W* on transcript.
March 23 - May 4: withdrawing from classes not permitted.

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.

Day	*Date*	*Lecture*	*Topic*	*Chapt*	*Notes*
M	*1/8*	*1*	*Matter, Elements and Compounds*	*1*	*No recitations all week*
W	*1/10*	*2*	*Measurements*	*1*	
F	*1/12*	*3*	*Atomic Structure, Periodic Table*	*2*	
M	***1/15***		***Holiday***		
W	*1/17*	*4*	*Isotopes, Radioactivity*	*2*	*Normal recitations on T and R*
F	*1/19*	*5*	*Nomenclature*	*2*	
M	*1/22*	*6*	*Chemical Equations*	*3*	*Normal recitations on T and R*
W	*1/24*	*7*	*Molecular Weight, Moles*	*3*	
F	*1/26*	*8*	*Calc. on Chem. Equations*	*3*	
M	*1/29*	*9*	*Acid, Base, Salts and Ions*	*4*	*Normal recitations on T and R*
W	*1/31*	*10*	*Oxidation Numbers*	*4*	
F	*2/2*	*11*	*Concentration of Solutions*	*4*	
M	*2/5*	*12*	*Review for Exam 1*		*Normal recitations on T and R*
W	***2/7***	***Exam 1***	***Chapters 1-4***		
F	*2/9*	*13*	*Energy, First Law*	*5*	
M	*2/12*	*14*	*Enthalpy of Reaction*	*5*	
W	*2/14*	*15*	*Calorimetry, Hess's Law*	*5*	*No recitations on T and R*
F	*2/16*	*16*	*Quantization of Energy*	*6*	
M	*2/19*		*Holiday*		
T	*2/20*	*17*	*Quantum numbers*	*6*	
W	*2/21*	*18*	*Orbitals*	*6*	
F	*2/23*	*19*	*Many Electron Systems*	*6*	
M	*2/26*	*20*	*Development of The Periodic Table*	*7*	*Normal recitations on T and R*
W	*2/28*	*21*	*Electron Ionization, Electron Affinity*	*7*	
F	*3/2*	*22*	*Metals and Nonmetals*	*7*	

M-F	***3/5-3/9***		***Spring Break***		***No recitations on T and R***
M	*3/12*	*23*	*Review*		*Normal recitations on T and R*
W	***3/14***	***Exam 2***	***Chapt 5-7***		
F	*3/16*	*24*	*Lewis Structures*	*8*	
M	*3/19*	*25*	*Octet Violation*	*8*	*Normal recitations on T and R*
W	*3/21*	*26*	*Electronegativity*	*8*	
F	*3/23*	*27*	*Bond Energies*	*8*	
M	*3/26*	*28*	*VSEPR Theory*	*9*	*Normal recitations on T and R*
W	*3/28*	*29*	*Covalent bonding*	*9*	
F	*3/30*	*30*	*MO Theory*	*9*	
M	*4/2*	*31*	*Ideal Gas Law*	*10*	*Normal recitations on T and R*
W	*4/4*	*32*	*Real Gases*	*10*	
F	*4/6*	*33*	*Liquids*	*11*	
M	*4/9*	*34*	*Phase Diagram*	*11*	
W	*4/11*	*35*	*Review*		*Normal recitations on T and R*
F	***4/13***	***Exam 3***	***Chapters 8-11***		
M	*4/16*	*36*	*Crystal Lattice, Metals*	*12*	
W	*4/18*	*37*	*Ionic Solids, Molecular Solids, Covalent-Network Solids*	*12*	*Normal recitations on T and R*
F	*4/20*	*38*	*Colligative Properties*	*13*	
M	***4/23***		***Make-up exam***		
W	*4/25*	*39*	*Gases in Solution*	*13*	*Normal recitations (reviews) on T and R*
F	*4/27*	*40*	*Final Review*		
W	***5/2***	***Final***	***11:30 a.m. – 1.20 p.m., BNR 102***		*Comprehensive*

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 electrolytes and non-electrolytes

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, moles, 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 multi-electron 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