CHM – 115 Fall 2011 Test 0

Note - Most of this will not be covered in lecture! We will review some of this during the first discussion period. It is up to you to review this material and get up to speed on it. The first WebAssign assignment will cover this and will be due by September 8th. This material should be review.

Matter & Measurements (Sections 1.1 – 1.8)

- Distinguish between physical and chemical properties and between physical and chemical changes.
- Distinguish mixtures, compounds, and elements.
- Distinguish accuracy and precision.
- Calculations with correct number of significant figures, using density, temperature conversions and unit conversions.

Atoms & Periodic Table (Sections 2.1 – 2.3; 2.6 – 2.7; 2.9)

- State the number of neutrons, protons, and electrons in an isotope, given its atomic number and mass number.
- Predict the characteristics of elements in different regions of the periodic table.
- Give the definition of a mole and calculate the moles present in a sample of a given mass.

Stoichiometry & Molarity (Sections 4.2 & 4.4)

- Use balanced chemical equations to solve stoichiometry problems
- Calculate the molarity of a solution.

These are suggested problems from the textbook that can get you up to speed on these review topics. Do as many or as few as you need to dredge up this information.

Problems:
Chapter 1 33, 35, 41, 43, 45, 49, 55, 57, 61, 63, 65, 67, 69, 71, **73**, 75, 77, 83, 85, 87, 89, 91, 93, 121, 123
Chapter 2 15, 19, 23, 51, 53, 57, 59, 61, 63, 65, 67, 69, 79, 81, 83, 85
Chapter 4 25, 27, 53, 55, 57

CHM – 115 Fall 2011 Test 1

What do we know about the structure of the atom?

What neon lights and solar cells have in common?

Energy (Section 1.5, 6.1 – 6.2, 7.2)

- Define energy.
- Describe two ways of transferring energy.
- Distinguish between exothermic and endothermic reactions from sign of ΔH.
- Describe light as E.M radiation
- Use the relationship between frequency, wavelength, and speed for waves

Problems: Chp 1: 18, 19, Chp 6: 2–5; Chp 7: 1–9, 37, 39, 41, 43, 45, 47

Development of Atomic Theory & Periodic Table (Sections 2.4 – 2.5; 2.8)

- Describe the historical development of the nuclear model of the atom.
- Calculate the atomic mass of an element from isotopic abundance data.

Problems: Chp 2: 7-12, 41, 43, 45, 49, 71, 73, 75, 77,

Problems with the Classical Model (Sections 7.2 – 7.4)

- Differentiate between continuous and quantized
- Calculate the energy, frequency, or wavelength of a photon using Planck's relationship
- Describe line spectra as a result of quantized electron energies
- Calculate the wave properties of any matter using the de Broglie equation
- Compare the Bohr model with the quantum mechanical description of the atom

Problems: Chp 7: 12 – 16, 24, 51, 53, 71, 75, 77, 79, 85, 87, 91, 93

Quantum Mechanics (Section 7.5 – 7.6, & 8.1 – 8.3)

- Describe orbital shapes as probability densities
- Identify s, p, and d orbitals by their shapes
- State the physical significance of the quantum numbers
- Apply the rules for assigning quantum numbers.
- Write electron configurations of atoms using box notation and spdf notation
- State the Pauli Exclusion Principle.
- Define effective nuclear charge and shielding and explain their effect on electron energy.

Problems: Chp 7: 59, 61, 63, 65, 67, 69, 73; Chp 8: 11–16, 43, 45

Results of QM - Periodic Trends (Sections 8.4 – 8.8)

- Correlate valence electron configurations with position on the periodic table
- Write electron configurations of ions using box notation and spdf notation
- Define ionization and electron affinity using words and reactions
- Use the trends in size to explain trends in ionization energy, and electron affinity

Problems: Chp 8: 28–36, 47, 49, 51, 53, 55, 57, 59, 61, 63, 65, 67, 69, 71, 73, 75, 77, 79, 81, 85, 91, 93, 99

CHM – 115 Fall 2011 Test 2

How are atoms joined together to make compounds?
Not only size but shape matters!

Experimental Evidence for Compounds – Moles Again (Sections 3.7 – 3.9)
- Use the molar mass as a conversion factor.
- Determine % composition of a compound, given its formula.
- Determine empirical and molecular formulas from data.

Problems: Chp 3: 57, 59, 63, 65, 67, 69, 71, 73, 75, 77, 79, 81, 85

Chemical Bonds & Classifications of Compounds(Sections 3.2 – 3.6, 9.1 – 9.6)
- Distinguish between the types of bonding.
- Write a correct name, given the formula, or correct formula, given the name of: molecular compounds, ionic compounds, and acids.
- Predict relative lattice energies.
- Define the octet rule.
- Explain the significance of electronegativity and what is meant by a polar covalent bond.

Problems: Chp 3: 25, 29, 31, 33, 35, 37, 39, 41, 43, 45, 47, 49, 51, 53, 55
Chp 9: 37, 43, 45, 47, 51, 55

Lewis Structures (Sections 9.7 – 9.10)
- Use the octet rule to draw a Lewis structure for polyatomic molecules.
- Calculate the formal charges for a Lewis Structure and determine the most likely structure.
- Define resonance and its relationship to the individual Lewis structures of molecules.
- Explain the limitations of the Lewis theory of bonding.
- Correlate bond strength and bond length.
- Define bond enthalpy.

Problems: Chp 9: 53, 57, 59, 61, 63, 65, 67, 69, 71, 73, 75, 77, 81, 83, 85, 87, 91, 107, 111

Lewis Structures & Molecular Shape (Sections 10.1 – 10.5)
- Predict the shape of a molecule using the VSEPR model, including approximate bond angles.
- Explain the distortion of the predicted bond angles in compounds with electron pairs located on the central atom.
- Distinguish between polar and non-polar bonds in terms of electron distributions.
- Using the VSEPR structure, predict if a molecule with polar bonds is a polar molecule.

Problems: Chp 10: 29, 31, 33, 37, 41, 43, 45, 47, 49

Molecular Shape & Bonding (Sections 10.6 – 10.7)
- Explain hybridization of orbitals as a correction to the valence-bond model.
- Predict the hybridization of atoms in simple molecules using the VSEPR structure.
- Explain the central tenants of Valence Bond Theory.
- Distinguish between sigma, σ, and pi, π bonds.
- Define single, double, and triple bonds.

Problems: Chp 10: 51, 53, 57, 59, 61, 63, 65

CHM – 115 Fall 2011 Test 3

Are molecules attracted to each other?
Why does soda go flat?

Pressure & Gas Laws (Sections 5.1 – 5.6)
- Define pressure on a molecular level.
- Solve problems using Boyle's, Charles', and the ideal gas law.

Problems: Chp 5: 29, 35, 37, 39, 41, 45, 47, 49, 51, 55, 57, 63, 65, 67, 69, 73, 93

Kinetic Molecular Theory of Gases (Sections 5.8 – 5.10)
- Explain the predictions of the gas laws using kinetic molecular theory.
- State and explain the postulates of the kinetic theory of gases.
- Explain gas behavior using the Maxwell Boltzman distribution.
- Explain the limitations of the ideal gas model.
- Describe conditions when the Ideal Gas Equation is not valid.

Problems: Chp 5: 79, 87, 89, 91, 133, 134

Intermolecular Forces, Liquids & Solids (Sections 11.1 – 11.9)
- Define dispersion forces, dipole-dipole forces, ion-dipole forces, and hydrogen bonding.
- Using the chemical structure, determine the type of intermolecular forces present in a substance.
- Predict the relative order of boiling points based on intermolecular forces.
- Define viscosity, surface tension, adhesion, cohesion, and capillary action.
- Using intermolecular forces, predict relative strengths of surface tension and viscosity.
- Explain trends in vapor pressures & boiling points of substances based upon IM forces.
- Interpret a vapor pressure curve and a phase diagram.
- Calculate energies involved in phase changes.

Problems: Chp 11: 49, 51, 59, 61, 65, 69, 71, 73, 75, 77, 79, 83, 85, 87, 89, 91

Solutions in Chemistry (Sections 4.5 & 12.1 – 12.4)
- Explain the steps in the process of dissolution.
- Describe the hydrophobic effect.
- Explain "dynamic equilibrium" in terms of solubility.
- Describe and contrast what happens when ionic and molecular compounds dissolve in water.
- Identify species present in solution using solubility rules

Problems: Chp 4: 4, 5; Chp 12: 29, 31, 33, 35, 37, 41, 43, 47, 49

Quantitative Description of Solutions (Sections 4.4, 12.5 – 12.7)
- Express concentration in molarity, mole fraction, molality, and percent by mass.
- Explain and use Henry's law.
- Perform calculations required for preparing solutions of a certain molarity, mole fraction or %.
- Complete dilution calculations.
- Convert between concentration expressions.
- Define/explain vapor pressure lowering, freezing point depression, and boiling point elevation.
- Use Raoult's Law and explain deviations from this law.
- Use colligative property data in calculations.

Problems: Chp 4: 53, 55, 57, 58, 59, 61, 63, 65; Chp 12: 51, 53, 55, 57, 59, 61, 63, 65, 75, 77, 81, 83, 85, 87, 101, 117

CHM – 115 Fall 2011 Test 4

How do we represent interactions of chemical compounds?

What goes on when we mix stuff together?

Writing & Using Chemical Equations (Sections 4.1 – 4.3, 5.7)

- Complete stoichiometry problems using balanced chemical equations.
- Complete stoichiometry problems using mass, solution, and gas data.
- Identify the limiting reactant in a chemical reaction.
- Calculate the theoretical yield and percent yield of a chemical reaction using the limiting reactant.

Problems: Chp 4: 31, 33, 39, 41, 43, 45; Chp 5: 77, 79, 81, 101, 105, 107

Enthalpy and Chemical Changes (Sections 6.1 – 6.8)

- Define a thermodynamic system and surroundings and thermal equilibrium.
- Quantify heat and work.
- Calculate heat flow from a calorimeter experiment.
- Use thermochemical equations to calculate amounts of energy in reactions.
- Use standard enthalpies of formation to calculate enthalpy changes for reactions. (Hess's law)
- Write formation reactions for compounds.

Problems: Chp 6: 31, 33, 35, 37, 41, 43, 45, 47, 51, 53, 55, 57, 61, 63, 65, 69, 71, 73, 75, 79, 89, 107, 115

Chemical Reactions (Sections 4.6 – 4.9)

- Describe the role of enthalpy, entropy, and free energy as the driving forces of chemical reactions.
- Write molecular, total ionic, and net ionic equations (identifying spectator ions)
- Predict products of precipitation reactions
- Distinguish between strong and weak acids and bases
- Assign oxidation numbers using rules
- Define oxidation and reduction in terms of electron movement and oxidation numbers.
- Identify species oxidized, reduced, oxidizing agents, reducing agents in chemical equations

Problems: Chp 4: 35, 67, 69, 71, 73, 75, 77, 79, 83, 85, 87