Matter and Motion Fall 2015 Final Review

We have covered chapters R, 1, 2, 3, 4, 5, 6, 7, 9, 10, & 11 in *Chemistry: An Atoms First Approach* by Zumdahl and Zumdahl. Constants, nonmetric conversion factors, solubility rules, a periodic table, and electronegativity chart will be provided on the exam. You will need to know formulas for density, molar mass, the ideal gas equation, and molarity. Plan to bring a calculator and something to write with.

Learning Objectives Weeks 1 – 9

Determine significant figures from calculations and their origin in measurements

Know the metric system and how to convert between different scales, eg. nano- to kilo-, etc…

Be able to create conversion factors and use them to convert between different units

Know the general process in the scientific method and explain why the parts are important

Translate between scientific notation and standard notation

Use the density equation to calculate mass, volume, or density

Be able to characterize electromagnetic radiation in terms of wavelength, frequency, and energy.

Understand how the emission spectrum of hydrogen demonstrates the quantized nature of the energy of its electron and be able to calculate photon energies from atomic transitions.

Be able to describe the quantum numbers n, l, ml, and ms and use them to write electron configurations for elements using the Aufbau principle, Hund's rule, and the Pauli exclusion principle.

Understand how the structure of the periodic table originates from electron configurations and how it can be used to identify core and valence electrons.

Describe the origin of general trends in ionization energy, electron affinity, and atomic radius in the periodic table and use these trends to predict reactivity.

Understand the mole as a unit of measure in chemistry and use it with molar mass to convert between moles, mass, and number of particles.

Learn to use the periodic table to predict the formulas of ionic compounds.

Learn the system for naming ionic and simple covalent compounds.

Use the concept of electronegativity to explain the formation of ionic, covalent, and polar-covalent bonds.

Use the concept of bond polarity to predict molecular polarity/Understand the relationship between bond polarity and molecular polarity.

Use the localized electron bonding model, the octet rule, and the concept of formal charge to draw Lewis structures of compounds and polyatomic ions.

Apply Valence Shell Electron Pair Repulsion (VSEPR) theory to predict the shape and polarity of molecules.

State the deficiencies of the localized electron bonding model and the need for a more sophisticated model.

Use Molecular Orbital diagrams for diatomic molecules.

Apply Molecular Orbital theory and bond order calculations to predict bond length and bond strength.

Use the 1st Law of thermodynamics to discuss the energy flow between a system and its surroundings.

Calculate the work done by an expanding gas at constant pressure and calculate the associated change in internal energy.

Define enthalpy, endothermic, and exothermic, and apply these concepts in calculating changes in energy due to chemical reactions.

Use the standard enthalpy of combustion to determine the energy content of fuels.

Use standard enthalpies of formation to calculate ΔH° for a reaction.

Use the Gas Laws (Boyle's, Charles's, and Avogadro's) to understand the basis of the Ideal Gas Law and relate between the pressures, volumes, temperatures, and moles of gas.

Use Dalton's Law of Partial Pressures to calculate the pressure of an ideal gas within a mixture of ideal gases.

Relate the kinetic energy, velocity, mass, and properties of gas atoms or molecules using the Kinetic Molecular Theory of gases.

Describe deviations from the ideal gas law and the behavior of real gases.

Calculate percent composition, molecular formula, and empirical formula

Write balanced chemical equations, complete ionic equations, and net ionic equations to describe chemical reactions

Use balanced chemical equations to determine the limiting reactant and calculate the percent yield

Identify types of chemical reactions including precipitation, acid-base, and oxidation-reduction reactions.

Use the solubility rules to predict if a reaction will occur between two aqueous reagents

Assign oxidation numbers to identify oxidation-reduction reactions and balance oxidation-reduction equations

Understand the factors affecting solubility including temperature, pressure, and molecular structure

Do calculations to quantify colligative properties such as vapor pressure depression, boiling point elevation, and freezing point depression

Use measurements of colligative properties of solutions to characterize the solute