Review Sheet for the Final Examination

Chapter 8
• Understand how the lattice energy is dependent upon the charge and size of ions
• Be able to determine electron configurations for ions, including transition metal ions
• Understand qualitatively how the radii of anions and cations differ from neutral atoms
• Understand the Born-Haber Cycle
• Be able to draw Lewis dot structures
• Know the trends in electronegativity and use them to distinguish polar covalent bonds from non-polar covalent bonds
• Be able to assign formal charges from the Lewis dot structure
• Use formal charges to compare stabilities of alternative Lewis dot structures
• Understand the concept and meaning of resonance structures and identify molecules where the bonding is best represented by a resonance structure
• Know the three exceptions to the octet rule and how to draw Lewis dot structures when the octet rule is violated
• Understand the relationship between bond order (single, double and triple bonds), bond length and bond strength (enthalpy)
• Use bond enthalpies to estimate $\Delta H_{\text{rxn}}$ for gas phase reactions

Chapter 9
• Use the VSEPR model to predict molecular geometry of molecules
• Understand the bond angle trends (deviations from the ideal bond angles) in molecules with unshared electron pairs or multiple bonds on the central atom
• Be able to identify polar and non-polar molecules
• Be able to identify the hybridization around the central atom in a molecule
• Understand the difference between $\sigma$ and $\pi$ bonds
• Use the concept of orbital overlap to predict the presence and number of $\pi$ bonds in a molecule
• Be able to predict when delocalized $\pi$ bonding will occur
• Be able to construct a molecular orbital diagram for a diatomic molecule and use this diagram to determine the bond order and determine whether a molecule will be paramagnetic or diamagnetic
• Use a molecular orbital diagram to predict whether adding or subtracting an electron will increase or decrease the bond length and strength
Key Concepts from Chapters 1-7

- Given an atomic symbol (i.e. $^{19}$F$^-$) determine the # of protons, neutrons and electrons, and vice versa
- Predict the empirical formula of an ionic compound
- Naming ionic compounds and binary molecular compounds
- Be able to balance chemical equations
- Convert between masses, moles and number of particles
- Determine limiting reactant, theoretical yield and % yield for a chemical reaction
- Use the concept of molarity with a balanced chemical equation to determine limiting reactants, theoretical yields, percent yields, etc. for solution reactions
- Be able to identify strong, weak and non-electrolytes
- Given two salt solutions, be able to use the solubility rules (solubility rules will be given) to predict the products of a metathesis reaction and write a balanced equation
- Understand simple oxidation-reduction reactions and be able to use the activity series
- Understand acid-base reactions and be able to work titration problems
- Be able to calculate molarity and the changes in molarity which occur when solutions are mixed together or diluted
- Distinguish endothermic and exothermic processes and reactions
- Given $\Delta H_{\text{rxn}}$ and the mass of a reactant calculate the total heat evolved/absorbed
- Use Hess's Law to calculate the enthalpy change for a reaction
- Use specific heat to relate changes in temperature with the amount of heat absorbed/evolved
- Temperature equilibrium problems (i.e. when you place a hot piece of metal in cold water what is the temperature when the system comes to equilibrium)
- Use enthalpies of formation to calculate enthalpies of reaction
- Be able to convert between wavelength, frequency and energy of a photon
- Be able to calculate the energy of the photon emitted/absorbed when an electron changes levels in the hydrogen atom
- Know the regions of the electromagnetic spectrum in order of decreasing energy and know the wavelength range corresponding to visible light
- Be able to convert between wavelength and velocity of matter (DeBroglie rel'n)
- Understand the relationship between the four quantum numbers, electron configuration, orbital names, shapes and energies
- Use Hund’s rule and the Pauli exclusion principle to derive the electron configuration of any atom or ion
- Understand how the electron configuration of the atoms relates to the periodic table
- Be able to determine the # of valence electrons for any atom from the periodic table
- Know the definitions and periodic trends in atomic radius, ionization energy (including 2nd, 3rd, 4th, etc. Ionization energy), electron affinity and electronegativity
- Be able to qualitatively compare the radius and ionization energy of atoms in an isoelectronic series ($O^{2-}, F^-, Ne, Na^+, Mg^{2+}, Al^{3+}$)

A sheet will be provided with the final examination containing all formulas you will need for the exam. Memorization of formulas or constants is not required.