# CHM-151 Hildebrandt Preliminary Topic List
# Exam #3 - Thursday April 22nd

**CHAPTER 8 - PERIODIC RELATIONSHIPS AMONG THE ELEMENTS**

Shielding Effect in Many-Electron Atoms
Effective Nuclear Charge: Shielding
Atomic and Ionic Radius (sizes)
Ionization Energy: the minimum energy (in KJ/mole) required to remove an electron from gaseous atom in its ground state (OFF)
Electron Affinity: is the energy of process when an electron is acquired by an atom (ON)

**CHAPTER 9 - CHEMICAL BONDING I: BASIC CONCEPTS**

Valence Electrons
Lewis Dot Symbol
Ionic Bond
Three Step Formation of Ionic Bond
Ionization-electron Affinity - Lattice Energy
Coulombs Law .. Higher Charged Atoms Form Stronger Lattice Energy, So Do Tiny Atoms
Covalent Bond
Sharing of Electrons
Lewis Dot Structures
Octet Rule
Single Bond
Double Bond
Triple Bond
Comparison of Ionic Vs. Covalent Bond
Ionic - Strong, Brittle, High Melting, Conduct When Molten or in Water
Covalent- Weak Forces ... Gases, Liquids, Soft Solids Low Melting, Don't Conduct Electricity
Electronegativity
Polar Covalent Bond
Polar Molecules
Lewis Dot Structures
Lewis Dot Structure for Ions
Formal Charges
Resonance
Resonance Structures
Exceptions to Octet Rule
Bond Dissociation Energy
Calculation of Heats of Reaction from Bond Energies

**CHAPTER 10 - CHEMICAL BONDING II: MOLECULAR GEOMETRY AND HYBRIDIZATION OF ATOMIC ORBITALS**

Molecular Geometry
VSEPR
Linear, Plane Triangle, Tetrahedral, Trigonal Bipyramid, Octahedral
Bond Angles
Dipole Moments
Molecule Polarity

Valence Bond Theory
Overlap of Partially Filed Orbitals
Hybridization
sp, $sp^2$, $sp^3$, $sp^3d$, $sp^3d^2$
Lone Pair Repulsion VSEPR
Nature of Double - Triple Bonds
Sigma Bond
Pi-bonds (in double and triple bonds)
Free Rotation Around Bond vs Multiple Bonds
Molecular Orbital Theory
Bonding Orbitals
Anti-Bonding Orbitals

**Chapter 5 - GASES** (I am not sure how far we will be into this chapter for Exam #3 - watch the class web page and announcements in class)
Pressure - Units
Atmospheres, Torr, Mm/hg
1 Atm = 760 Torr
Kelvin Temperature = C + 273.15
Liters
"Moles"
Boyle's Law
Charles' Law
Avogadro's Law
Ideal Gas Law PV=nRT
Gas Law Constant
R = 0.082057 L*atm/k*mole
If You Know Three Properties of a Gas You Can Calculate the Fourth
PV/T = PV/T
Combining Volumes of Gases
Standard Temperature and Pressure
0 Celsius and 1 Atm Pressure
1 Moles Gas at STP = 22.4 Liters
Dalton's Law of Partial Pressure
Kinetic Molecular Theory
Lots of Space Between Atoms
Molecules in Constant Motion
Collisions Are Perfect (Elastic)
No Attractions Between Molecules
*Average Kinetic Energy of Molecules Is Proportional to the Kelvin Temperature
Application of KMT to Explain Gas Laws.
Effusion/Diffusion

**I decided to make this list cover topics all the way to the final. Watch the class web page and for announcements in class.**

**CHAPTER 11 - INTERMOLECULAR FORCES AND LIQUIDS AND SOLIDS**
Phases

Intermolecular Forces
Dipole-dipole Forces
Ion-dipole Forces
London Dispersion Forces - Very Weak but Go "Up" with Atomic/molecular Weight
Hydrogen Bond - H Bonded to N O F
"Like Dissolves Like"
Use Molecular Forces to Predict about Melting and Boiling Points
Properties of Liquids
Surface Tension
Unique Properties of Water
Vaporization
Heat of Vaporization
Vapor Pressure
Vapor Pressure Vs. Temperature
Boiling Point a Function of Applied Pressure
Surface Tension, Capillary Action, Viscosity

**CHAPTER 12 - PHYSICAL PROPERTIES OF SOLUTIONS**

Units of Concentration
Molality
Mole Fraction
Molarity
Colligative Properties
Vapor Pressure Lowering
Boiling Point Elevation $\Delta T = k_b * \text{molality}$
Freezing Point Depression $\Delta T = k_f * \text{molality}$
Osmotic Pressure Pressure $= \pi = \Delta m * R * T$
The Solution Process
Factors Affecting Solubility: Pressure and Temperature
Colloids