Chem 101A Exam 4 Concepts

Chapter 7 – Modern Atomic Theory

- ✓ Use formulas that relate energy of photon, frequency, wavelength, speed of light, and the Rydberg Equation
- ✓ Notable scientists and their contributions: Rutherford, Bohr, Planck, de Broglie, Heisenberg, Schrödinger.
- ✓ The four Quantum Numbers (n, l, m_l, m_s), when they are allowed, how they describe the electron state, and how they relate to:
  - ⇨ Energy levels, orbitals (number allowed, shapes, sizes), electrons and spin
  - ⇨ Pauli Exclusion Principle
- ✓ Electron configurations of a given atom
  - ⇨ $1s^2 2s^2 2p^6$…etc
  - ⇨ Short/abbreviated method, i.e. [noble gas]…the rest
  - ⇨ Orbital diagrams (and Hund's Rule)
  - ⇨ Exceptions to predicted electron configs (Cr, Mo, Cu, Ag, Au)
  - ⇨ Valence electrons vs Core electrons
  - ⇨ Periodic table and electron configs (e.g. alkaline earth metals last sublevel ns^2)
- ✓ Periodic Trends: Ionization Energy, Atomic Radius, Electron Affinity, Electronegativity (Ch8)

Chapter 8 – Chemical Bonding

- ✓ Covalent vs Ionic bond – energy model
- ✓ Ionic bond, coulomb's law and lattice energy (they all relate)
- ✓ Ionic radius trends (atom vs ion, and compare isoelectronic series)
- ✓ Bond energies to calculate ΔH_{rxn} ($\Delta E_{bonds\ broken} - \Delta E_{bonds\ formed}$)
- ✓ Lewis structures predict which atoms bond to which and nonbonding electrons (lone pair)
  - ⇨ 2 valence electrons max: H, He
  - ⇨ 8 valence electrons max: 2nd row elements
  - ⇨ <8 valence electrons exceptions: Be=4, B=6 (formal charge)
  - ⇨ OK >8 valence electrons: 3rd row elements and below
  - ⇨ Use formal charges to evaluate best structures—double bonds to central atom
  - ⇨ When to draw resonance structures, and how many (resonance = average)
- ✓ VSEPR structures predict 3-dimensional arrangement of electron pairs in space
  - ⇨ Know and be able to predict 3D structure, sketch, including bond angles structures with these common geometries: any linear, tetrahedral, trigonal pyramid, bent, trigonal bipyramid, see-saw octahedral, and square planar.
  - ⇨ Predict molecular polarity (dipole moment). Recall, in symmetrical structures equal dipoles cancel out (non-polar or zero dipole moment), while in asymmetrical structures dipoles will sum (non-zero dipole moment).
- ✓ Born-Haber cycle and calculations