Review Notes for CHEM 115N Final Exam

I   Atoms, Molecules & Ions

A.   Know definitions: protons, electrons, neutrons, isotopes, ions, atomic mass units vs atomic weight

B.   Know how to determine atomic weight based on knowledge of the natural abundance of the isotopes and their mass numbers

C.   How is the periodic table arranged: what is a period? A group? What are metals, nonmetals & metalloids?

D.   Be able to recognize the assigned polyatomic ions

E.   Rules for naming binary molecular compounds, the Stock system for metallic compounds

II   Calculations with Chemical Formulas & Weights

A.   Be able to write chemical formulas based on a knowledge of the oxidation numbers of the elements in the compound

B.   Be able to balance chemical equations (both mass and charge balanced)

C.   Be able to calculate molecular weights or molar mass.   What is Avogadro's Number?

What is a "mole"? What is molar mass?

D.   **Be able to determine the "limiting reactant" and how to calculate amounts of products based on amount of reactant available (also amount of reactant that must have been present based on amount of product formed).**

E.   **Be able to determine empirical formula from mass percentages of the elements as well as calculate mass percentages from a knowledge of the formula.   Calculation of molecular formula from a knowledge of the molar mass and empirical formula**

III   **Chemical Reactions - An Introduction**

A.   **Know the definition of strong and weak electrolyte, nonelectrolyte and how to determine if a solution contains a strong or weak electrolyte**

B.   **Be able to write & balance a net ionic equation, molecular equation**

C.   **Know the different types of reactions and how to identify them - precipitation (solubility rules), acid-base, oxidation-reduction**

D.   **Be able to determine molarity of an unknown acid or base for information given about titrant, volume of acid, etc. - the stoichiometry**

of neutralization reactions, volumetric analysis

E.   Be able to balance simple oxidation-reduction equations

F.   Know how to calculate the molarity of a solution, use dilution equation

IV   The Gaseous State

A.   Know the empirical gas laws, the Ideal Gas Law, use of gas constant

B.   Be able to calculate pressures, mole fractions in mixtures of gases

V   Thermochemistry

A.   Know the definitions of the types of energy, intrinsic vs extensive properties, concept of a State function, heat of reaction (endothermic, exothermic, enthalpy)

B.   Be able to calculate heat evolved/absorbed (using specific heat, Hess's Law). Know formula $q = sm\Delta T$

VI Quantum Theory

A. Calculations using $c = \lambda\nu$, $E = h\nu$
B. Meaning of atomic line spectra, Bohr Theory of the atom
C. Quantum numbers - what do the represent, be able to determine l, m_l for an electron based on knowledge of shell & subshell - which quantum states (numbers) are allowed/not allowed
D. Be able to build-up the electronic configuration (Aufbau Principle, Pauli Exclusion Principle, Hund's Rule) based on a knowledge of the atomic number, ionic charge (if applicable)
E. Be able to predict atomic radii, first ionization potential, electron affinity from knowledge of electronic configuration & periodic table

VII Ionic and Covalent Bonding

A Be able to describe ionic, covalent, polar covalent and coordinate covalent bonding. Be able to predict ionic radii based on a knowledge of the electronic configuration & the periodic table

B Electronegativity - prediction of ionic, polar covalent & covalent bonding based on a knowledge of the electronic configuration & the periodic table

C Lewis electron-dot formulas - be able to write these using the rules

D Be able to recognize resonance structures, calculate formal charge of the atoms in a Lewis electron-dot structure

E Be able to predict molecular geometry from a knowledge of the Lewis electron-dot structure/valence shell electron pair repulsion (VSEPR) theory

F Be able to predict bond length and strength from a knowledge of bond order. Be able to estimate heat of reaction from a knowledge of the bond energies of the reactants and products