Honors Chemistry Midterm Outline

The midterm exam covers topics from the summer assignment through the most recent topic, as listed below. The weighting of the exam is 50% multiple choice-without a calculator, 50% open-ended with a calculator.

The total exam will last 1hr and 45mins starting with the non-calculator portion first. If you finish that section before time is called, you may move onto the calculator section, but you may not go back.

I. Summer assignment + Math and Measurement

A. Metric system and standard prefixes of centi, milli, kilo, deci, and nano
B. Significant figures in measurement and calculation
C. Scientific notation with and without calculators
D. Error, accuracy (with % error), and precision applications
E. Density of matter
F. Unit analysis problem solving

II. Atomic Theory, Electron Configuration, and Quantum Model of the Atom

A. Nuclear model of the atom: Rutherford's experiment
B. Relative mass, charges, and purposes of protons, neutrons, and electrons
C. Atomic weight, mass number, atomic number, and relative abundance definition and usage
D. Electromagnetic radiation, relationships of $E=h\,f$ and $c=f\,\lambda$
E. Photon concept of light and quanta
F. Emission spectra and photoelectric effect
G. Quantum mechanical model of the atom, including orbital-concept of electrons

III. Periodic Trends and Electron Configuration patterns

A. Electron configurations of s, p, d-block elements and their common ions
B. Periodic trends of atomic and ionic radii, ionization energy (and successive ionization energy), metallic character, common ions, effective nuclear charge
C. Orbital diagrams, electron filling (Aufbau's Principle and Hund's Rule) and stability
D. Element classifications-by family name, cation/anion, metal/nonmetal, chemical reactivity

IV. Matter, Formula Writing and Naming

A. Element/compound/mixture identification and separation
B. Formula writing and naming of binary ionic, binary molecular, and binary acid compounds, including transition metals with multiple charges
C. Common (from the PT) and required ions (from the summer assignment)

V. Chemical Reactions

A. Writing and balancing equations/law of conservation of matter
B. Classifying and predicting products of synthesis, decomp, SR, DR, and combustion reactions, as well as common "special reactions" presented in class
C. Determining relative reactivity
D. DIssociation of ionic compounds in water
E. Net ionic equations and common solubility rules for formation of precipitates

VI. The Mole

A. Definition and common calculations between mass, moles, particles, and atoms/ions
B. Molar mass and molarity determination and application
C. Law of definite composition and percentage composition by mass
D. Empirical and molecular formula relationship, and determination

VII. Stoichiometry

A. Using a chemical reaction and determining mole ratios
B. Calculating mass, mole, molarity, and molecular relationships within a chemical reaction
C. Limiting reactant concept and problems
D. Using percentage composition and percentage purity in calculations

VIII. Properties of gases

A. Definition, units, and applications of pressure
B. Measuring pressure with a U-tube manometer
C. Boyle's, Charles', Gay-Lussac's Law relationships (know how they are related, not the names)
D. Combined gas law
E. Avogadro's Law and application to reactions as well as gas samples
F. Ideal gas law problems PV=nRT
G. Molar volume 22.4 mole/L usage and limitations
H. Gas stoichiometry and density
I. Kinetic Molecular Theory summarizations
J. Graham's Law/DIffusion/Effusion rates

IX. Nuclear Chemistry

A. Alpha, beta +/-, and gamma decay and bombardment equation (with neutrons and protons)
B. Half-life concept and calculations
C. C-14 dating concept and calculation
D. Fission/Fusion processes
E. Strong force changes and resulting energy calculations