Final Exam Study Guide

I. Laboratory Safety and Techniques

A. Lab Safety - Theory
   1. List and explain 4 routes of entry into the body for chemicals
      a) Describe prevention for each method
   2. List and explain 3 ways a chemical can harm your body
   3. Define and explain LD50, TLV, and other measures of toxicity

B. Lab Safety - Practice
   1. Safety Equipment
      a) Demonstrate how to use goggles, apron, fire extinguisher, fire blanket, fume hood
   2. Explain and follow all safety rules
   3. Equipment - be able to identify all equipment at you lab station by sight. Spelling counts.
   4. be able to demonstrate proper lab techniques for
      a) measuring mass on a balance
      b) measuring length with a ruler
      c) measuring volume with graduated cylinders, burettes, pipettes
      d) pouring liquids and transferring solids
      e) filtration
      f) lighting the Bunsen burner
      g) washing glassware
      h) using computer to collect and record data
      i) writing a lab notebook - all parts, especially the following:
         (1) setting up a chemical information table
            (a) explain all information and know where to find it or how to calculate it (chemical name, chemical formula, formula mass, density, bp, mp, toxicity, solubility)
         (2) recording data
         (3) writing calculations

II. 1.Measurement; SI; graphing

A. Explain advantages to the SI system.
B. Know the 7 fundamental units and their abbreviations.
C. Define *derived unit* and list some commonly used derived units.
D. Know the 7 assigned conversion factors
E. Convert within the metric system using units for length, mass, volume, and combinations of units.
   1. Change: 250 g/L to kg/L
F. Explain/show how to make a graph of data you collected in lab, and interpret the data.
   1. Use computer graphing programs after you understand the basics
G. Define accuracy and precision
   1. Explain the difference between the 2
   2. Tell whether a given set of measurements us accurate, precise, neither, or both.

III. Problem Solving and Calculations

A. Use a given set of steps to solve a problem.
   1. write down the knowns 2) write down the unknowns etc.
      a) Use these steps in solving density, specific heat and density problems.

B. Use significant figures in all calculations (+ - x ÷ .)
   1. Be sure you know how to deal with zeros.
   2. Remember the difference in doing addition/subtraction and multiplication/division.
C. Use scientific notation in calculations whenever convenient.
D. Know how to use your calculator. (BRING your calculator!)

E. Calculate density: OR use density to find mass or volume.
F. Find specific heat OR heat using the relationship $Q = mc\Delta t$.
    1. Know what data you must have in order to do this type of calculation.
G. Convert grams <—> moles.
    1. Elements and compounds
    2. Use gram-formula masses

IV. Know about the periodic table:

A. Be able to locate, describe, list characteristics of, and compare:
B. Alkali metals Alkali earth metals Metals Nonmetals Metalloids
Border between metals and nonmetals Noble gases Halogens
Transition metals s,p,d,f blocks

C. Explain how to find the number of protons, neutrons, and electrons of an element by consulting the periodic table.
D. State and explain the periodic law.
E. Electronegativity; where is it high? low?
F. Atomic radii: where are they large? small?
G. Define mass number, atomic number, isotope.
H. Know the names and formulas for common monatomic ions.
    1. Explain how and why they form.

V. Atomic Theory and Evidence for Atomic Structure

A. Explain Dalton's Atomic theory and relate it to 3 important laws in chemistry.
    1. Describe the structure of the atom, and the history of the discoveries leading up to the atomic model currently in use.
    2. Define resonance, hybridization
    3. Describe the plum pudding model, the planetary model, and the quantum mechanical model.
B. Do an electron configuration, orbital notation, and electron dot structure for both an atom & an ion.
C. Name and explain each of the 4 quantum numbers.
D. Relate energy level changes of an electron to its atom's emission spectrum.
    1. Tell how the electrons are excited and what happens when they lose their energy.
    2. Explain why different colors are produced.

VI. Chemical Bonding

A. Explain the types of chemical bonding - ionic, covalent (polar covalent, nonpolar covalent)
B. Tell whether a bond between two atoms is covalent or ionic. Must be able to do this in 2 ways:
    1. by using electronegativity values (given on a chart)
    2. by looking at the types of atoms involved (ex. metal - nonmetal)
C. Draw Lewis structures for simple molecules and polyatomic ions

VII. Compounds, Formulas, and their meanings

A. Name a compound, given the formula. Write a formula (from ions or elements) given a name.
B. Recognize ionic and molecular compounds and use the correct method of nomenclature for each.
C. Be able to name ionic and covalent compounds and acids.
D. list the elements whose particles usually exist diatomically.
E. Calculate formula mass and molar mass for a compound.
    1. Choose a few compounds and practice.
    2. tell the difference in the 2 terms.
F. Calculate percent composition.
G. Find empirical and molecular formulas.

VIII. Writing and balancing chemical equations

A. Given a word equation, write a correctly balanced formula equation.
B. Given the reactants, predict the products of a chemical equation, and write a correctly balanced chemical equation.
C. Know the 5 types of reactions and their subtypes.
D. Be able to use the activity series and the solubility table.
E. Know and use all reaction symbols.

IX. Stoichiometry: solve problems involving

A. the mass of a product that would be obtained based on the masses of the reactants used:
    1. mole-mole, mole-mass, mass-mole, mass-mass problems
B. limiting reagent problems, including those involving gases.
** You must master the preceeding objectives first.

X. Kinetic Theory

A. Explain the kinetic theory as related to solids, liquids, and gases.
    1. Remember: Particles move and collide.
B. Explain phase changes.
    1. Describe what happens as a solid at a temperature below its freezing point is turned to steam.
    2. Relate your description to values for heat of fusion, heat of vaporization, and $Q = mc\Delta t$

XI. Solve gas law problems involving Boyle's Law, Charles' Law, combined gas laws, the Ideal Gas Law, Graham's Law, and Dalton's Law of partial pressures.

A. Convert volumes of gases to moles of gases
    1. use the relationship 22.4 liters of gas at STP - 1 mole of the gas

XII. Describe 4 kinds of intermolecular forces.

A. Know other types of bonding (metallic, hydrogen, van der Waals, dispersion interaction, and tell which are strong; which are weak.

XIII. Water

A. Discuss its structure and explain why it is polar.
B. Discuss the implications of hydrogen bonding on vapor pressure, boiling point, freezing point, formation of ice, surface tension.
C. Discuss the behavior of water as a solvent, and the process of solvation.
D. Explain why water expands as it freezes.

XIV. Explain the concept of solubility and the factors affecting it.

A. Explain how solutions form
B. Calculate concentrations of solutions and use concentration to solve related problems:
    1. Molarity
    2. molality
    3. dilutions
    4. freezing point depression; boiling point elevation

XV. Discuss properties of acids and bases. Explain acids as did Arrhenius, Lewis, Bronsted.

A. Calculate pH, $[H^+]$, $[OH^-]$
B. Derive the equation used from the dissociation of water.
C. Explain how indicators (for example, litmus or phenolphthalein) change color depending on the acidity of the solution.
D. Perform an acid-base titrtation and calculate the concentration of one of the solutions

XVI. General definitions (not included elsewhere):

chemistry		
physical properties	chemical properties	phlogiston theory
law	hypothesis	data
quantum	photon	electron affinity
ionization energy	Avogadro's number	theory

XVII. PEOPLE TO KNOW: Be able to relate each person to the contribution he made to chemistry, and explain briefly. It might be useful to group the people with related contributions; for example, everyone who discovered parts of the atom, or to put them in chronological order.

Dalton	Rutherford	Avogadro	Mendeleev	Millikan
J.J. Thomson	Einstein	Bohr	Lavosier	Chadwick
Democritus	Pauli	Planck	de Broglie	Heisenberg
Schrodinger	Boyle	Charles	Gay-Lussac	Arrhenius