CHM 151

FINAL EXAM REVIEW

Chapter 1: Chemistry and Measurements

1. Physical and chemical change, physical and chemical properties.
2. Measurements, precision and accuracy, significant figures in measurements and calculations.
3. SI and metric system units and conversions (learn the prefixes and their exponential notation).
4. Density, volume to mass or mass to volume conversions.
5. Temperature units and conversions.

Chapter 2: Atoms, Molecules, Ions

1. Atomic structure (protons, neutrons, and electrons), atomic number, mass number, isotopes, natural abundance of isotopes.
2. Organization of the Periodic Table: groups, periods, metals, nonmetals, metalloids; properties of same group elements.
3. Charges of ions of main group elements: cations and anions.
4. Ionic and covalent (molecular) compounds, empirical and molecular formulas.
5. Names and formulas of chemical compounds: binary ionic, ternary ionic, binary covalent, binary acids, ternary acids, and hydrates.
6. Writing and balancing chemical equations.

Chapter 3: Calculations with Chemical Formulas and Equations

1. Atomic mass and molecular mass, diatomic molecules.
2. Avogadro's number, mole, molar mass, grams to mol, mol to grams, mol to number of particles, or number of particles to mol conversions.
3. Percent composition of chemical compounds, determining empirical and molecular formulas.
4. Stoichiometry: calculating amounts of reactants and products based on the balanced chemical equation.
5. Limiting reactant.
6. Theoretical yield, actual yield, percent yield.

Chapter 4: Chemical Reactions

1. Definition of a solution.
2. Solubility rules.
3. Molarity, definition and calculation, preparing solutions by dilution method.
4. Classifying reactions.
5. Double replacements reactions: precipitation, acid-base.
6. Strong acids and bases, weak acids and bases.

7. Molecular, total ionic, net ionic equation.
8. Predicting products in double replacement reactions.
9. Acid-base titration method, calculating volume or molarity of solution, recording volume measurements.
10. Oxidation-reduction reactions: oxidation and reduction definitions, oxidation numbers, oxidizing and reducing agents, half-reactions.

Chapter 5: The Gaseous State

1. Pressure: definition, measuring devices (barometer and manometer), reading pressure measurements, units and conversions.
2. Gas laws: temperature, pressure, volume, amount of gas relationships; ideal gas law.
3. Postulates of the kinetic molecular theory, average kinetic energy-temperature relationship.

Chapter 6: Thermochemistry

1. Definitions of enthalpy, exothermic and endothermic reactions.
2. Heat calculations based on calorimetry: $q = m(T_2-T_1)s$.
3. Calculating enthalpy change of a reaction using Hess's law.
4. Calculating enthalpy change of a reaction at standard conditions using the standard enthalpies of formation of the reactants and products.

Chapter 7: Quantum Theory of the Atom

1. Principal energy levels, sublevels, orbitals.
2. Energy changes of electrons in excited atoms.
3. Quantum numbers, allowed values of the four quantum numbers.

Chapter 8: Electron Configurations and Periodicity

1. Building up electron configuration of neutral atoms in their ground state using the Aufbau's principle.
2. Electron configuration of ions.
3. Periodic trends for atomic size, ionization energy, electron affinity, metallic and nonmetallic character, acidity and basicity of metallic and nonmetallic oxides.

Chapter 9: Ionic and Covalent Bonding

1. Formation of ionic bond, strength of an ionic bond (Coulomb's Law), lattice energy, properties of ionic compounds, comparing strength of ionic bonds based on the melting point.
2. Formation of a covalent bond, coordinate covalent bond
3. Electronegativity: definition and periodic trend.
4. Polar and nonpolar covalent bonds, evaluating polarity of a bond based on the electronegativity difference.

5. Drawing Lewis electron-dot structures, resonance, formal charges.
6. Single, double, and triple covalent bond: bond length, bond strength, and bond order.
7. Bond energies: calculating enthalpy change of a reaction using bond energy values.

Chapter 10: Molecular Geometry and Chemical Bonding Theory

1. Predicting electron-group geometry and molecular geometry (shape or bond angles) from Lewis electron-dot structures.
2. Predicting polarity of molecules.
3. Hybridization theory.

Chapter 11: States of Matter; Liquids and Solids

1. Phase changes: melting/freezing, vaporization/condensation, sublimation/deposition.
2. Phase diagrams.
3. Heating/cooling curve representing phase changes, calculations of heat based on a heating/cooling curve.
4. Intermolecular forces in liquids and solids, evaluating their strength.
5. Properties of substances affected by the intermolecular forces: surface tension, capillarity; viscosity, melting point, boiling point.

Chapter 12: Solutions

1. Factors affecting the solubility of ionic and covalent substances.
2. Concentration expressions: percent by mass, percent by volume, molarity, molality, mole fraction.
3. Colligative properties, definition.
4. Effect on number of solute particles on the vapor pressure, freezing point, boiling point, and osmotic pressure of a solution.