CHEM 210 · Final Exam Review · Fall 2017

1. **Dimensional Analysis** (Unit conversions method)

2. **5-step Method Problem-Solving Approach**
   - Density and Other Formulas & Conversions

3. **Metric System**
   - Base Units
   - Prefixes
   - Metric - U.S. System Relationships

4. **Significant Figures**

5. **Error Analysis**
   - Percent Error
   - Standard Deviation & Relative Range
   - Accuracy vs. Precision

6. **Chemical and Physical Properties and Changes**
   - Mass, Volume, Density
   - Melting Point, Boiling point, Specific Heat Capacity
   - Flammability & Other Reactivity

7. **The Mole & Basic Atomic Structure**
   - The Mole Concept
   - Avogadro's Number
   - Protons, Neutrons, Electrons
   - Average Atomic Mass / Isotopes

8. **Solutions**
   - General Concepts
   - Concentrations:
     Molarity, Mass Percent, Parts-per-million (ppm), ppb, etc.
   - Conversions between M and % or ppm, etc.

9. **Formulas and Naming**
   - Ionic compounds
   - Covalent compounds
   - Acids
   - Percent Composition
   - Empirical and Molecular Formulas
   - Combustion Analysis

10. **Chemical Reactions**
    - Types of Reactions (5 Simple Types)
    - Predicting Products
    - Writing Complete Balanced Equations
    - REDOX Reactions

11. **Stoichiometry**
    - Basic Principles
    - Limiting Reagents
    - Solution Stoichiometry & Titrations
    - Theoretical Yields, Actual Yields, Percent Yields

12. **Gas Laws**
    - Pressure
    - Kinetic Molecular Theory
    - Combined Gas Law (& Individual Gas Laws)
    - Ideal Gas Law
    - Density of Gases
    - Dalton's Law of Partial Pressures
    - Graham's Law of Diffusion
    - Real vs. Ideal Gases
    - Gases and Stoichiometry

13. **Thermochemistry**
    - Law of Conservation of Energy
      (1st law of Thermodynamics)
    - Application of 1st Law: 1st Calorimetry: $-q_{system} = q_{surroundings}$
    - Heat & Specific Heat Capacity (of a material): $q = mC_p\Delta T$
    - Heat & Heat Capacity (of an object): $q = Hc\Delta T$
    - Heat of Reaction Relating to a Balanced Equation:
      $$\Delta H_{reaction} = \frac{q_{reaction}}{moles\ reacting} \times coefficient$$
    - Hess's Law
    - Molar Heat of Formation Concept & Reaction
    - $\Delta H^o_{reaction}$ from $\Delta H^o_{formation}$

14. **Electronic Structure of the Atom**
    - Electromagnetic Radiation
    - Emission Spectra and the Bohr Model
    - Energy Transitions and Quantum Theory
    - Wave / Particle Duality of Light
    - Photons
    - Quantum Numbers
    - Electron Configurations

15. **Bonding and Molecular Structure**
    - Ionic Bonding
    - Covalent Bonding
    - Electron Dot Structures
    - Octet Rule
    - Formal Charges
    - Resonance
    - VSEPR – Molecular Shapes
    - Hybridization
    - Electronegativity
    - Polar Bonds and Molecules
    - Valence Bond Theory: Orbital overlap
    - Sigma and Pi Bonding
    - Structural Formulas of Simple Organic Molecules (CHNO)
    - Isomerism (cis-/trans- and structural)

Study Suggestions:

The FINAL EXAM is COMPREHENSIVE. Be sure you are comfortable both with recent material (there will be a slight emphasis on these topics) and material covered early in the semester! The list above is only a guide and may not include every topic or subtopic that might be covered on the exam.

The FINAL EXAM will focus on PROBLEMS. The best way to prepare is to rework problems. *Some Hints:*

- Rework at least a handful of the ones you think are "easy". Make sure you still know the basics!
- Spend more time on kinds of problems you find more challenging – look to your notes and the reading when you are stuck.
- Rework problems without looking at the answers – use the answers only to check!
- You can use the exams, quizzes, worksheets, and problem sets as sources of problems – there are plenty of options for practice.

The FINAL EXAM will also include CONCEPTS. Reviewing course notes and the readings will best prepare you for those questions.

Omitted Topics

- molality
- Freezing Point Depression / Boiling Point Elevation

- Heat & phase changes ($q_x = n\Delta H_x$)

- Phase Diagrams
- Phase Changes

- Periodic Trends of Chemical Properties

- Bond Order, Length, Energy
- ΔH from Bond Energies

16. Solids & Liquids
    - Intermolecular Forces
    - Properties and Intermolecular forces

(know polyatomic ions)