

**Chem 261**  
**Assignment 1 & Lecture Outline 1**  
**Nature of Matter, Chemical Bonds, Functional Groups, Intermolecular**  
**& Intramolecular Forces, Infrared Spectroscopy**

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**Read**

*Organic Chemistry*, Solomons, Fryle & Snyder 13<sup>th</sup> Edition (Electronic)

- Functional Group List – Learn to recognize – Please see Green Handout – also p 75 of text
- Periodic Table – Inside Back Cover - know 1<sup>st</sup> 10 elements (up through Neon)
- Relative Strength of Acids and Bases – Inside Back cover (reference only)
- Chapter 1 –Introduction & Review: Structure, Formulas & Bonding (Resonance, Formal Charge, Orbitals, Hybridization)
- Chapter 2 –Functional Groups & Infrared Spectroscopy (Electromagnetic Spectrum, Molecular Vibrations, Intramolecular and Intermolecular Forces etc)
- Chapter 3 - Acids & Bases, Energy Changes

**Problems:**

Do **Not** turn in, answers available in "Study Guide Student Solutions Manual " Solomons, Fryle, Snyder

- **Chapter 1:** 1.1 to 1.8; 1.10 to 1.14; 1.16 to 1.25; 1.28; 1.35; 1.36
- **Chapter 2:** 2.3; 2.4; 2.7; 2.29; 2.30; 2.46
- **Chapter 3:** 3.1; 3.6; 3.18; 3.20

**Lecture Outline 1**

**I. Introduction - Course Organization, Nature of Science and Chemistry**

- A. What is Science?
- B. What is Matter?
- C. Basic concepts and definitions - atoms, moles, etc.

**II. Physical Properties and Purity**

- A. Purity
- B. Comparison of Physical Properties
- C. Methods of Purification
  - 1. Crystallization
  - 2. Distillation
  - 3. Extraction
  - 4. Chromatography
  - 5. Molecular Filtration – Dialysis

### III. Analysis

- A. Qualitative - Organic or Inorganic
- B. Quantitative - Calculation of molecular and empirical formula

### IV. Atomic Structure

- A. Theory - wave functions and orbitals
- B. Periodic Table - Pauli principle, Hund rule, Aufbau

### V. Molecular Structure

- A. Ionic bonding
- B. Covalent bonding
  - 1. Molecular orbitals - Linear Combination of Atomic Orbitals (LCAO)
  - 2. Hybridization and formation of sigma ( $\sigma$ ) and pi ( $\pi$ ) bonds
    - a.  $sp^3$
    - b.  $sp^2$
    - c.  $sp$
- C. Size and Shape of Molecules
  - 1. Bond Lengths and Hybridization
- D. Representation of Molecules
  - 1. Lewis Structures
  - 2. Formal Charge
  - 3. Resonance

### VI. Intermolecular Forces (Forces between different molecules)- van der Waals forces

- A. Electronegativity and Dipoles
- B. Dipole-Dipole Interaction
- C. London Forces
- D. Hydrogen Bonding

### VII. Chemical Reactivity

- A. Bond Energy and Equilibrium
  - 1. Enthalpy
  - 2. Entropy
  - 3. Equilibrium
- B. Rate of Reaction and Activation Energy
- C. Acid-Base Reactions
  - 1. Lowry - Bronsted
  - 2. Acidity Constant and  $pK_a$
  - 3. Lewis acids and bases

### VII. Infrared Spectroscopy

- A. Electromagnetic Spectrum
- B. Origin of Infrared Absorption
- C. Utility and Selected Examples (most of this material will be covered in the Laboratory)