

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

Read

Organic Chemistry, W. Ogilvie et al. 1st Edition – 2018 – Nelson Ltd.

- Functional Group List – Learn to recognize – Please see Green Handout – also p 76 of text
- Periodic Table – <http://www.ptable.com/#Writeup/Wikipedia> - know 1st 10 elements (up through Neon) – atomic numbers, atomic weights (2 significant figures), electron configuration
- Relative Strength of Acids and Bases – page 257 (reference only)
- Chapter 1 –Introduction & Review: Structure, Formulas & Bonding (Resonance, Formal Charge, Orbitals, Hybridization)
- Chapter 2 –Functional Groups, Intramolecular and Intermolecular Forces, ignore most naming
- Chapter 14 – Infrared (IR) Spectroscopy (Electromagnetic Spectrum, Molecular Vibrations), ignore mass spectrometry for now
- Chapter 6 - Acids & Bases, Energy Changes

Problems:

Do **Not** turn in, answers available in "Study Guide Student Solutions Manual " W. Ogilvie et al.

- **Chapter 1:** 1.1 to 1.12; 1.15; 1.19; 1.20; 1.27; 1.29
- **Chapter 2:** 2.1 to 2.8; 2.14; 2.16; 2.23 to 2.25; 2.41
- **Chapter 6:** 6.3; 6.5; 6.11; 6.17

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 (σ) and pi (π) 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)