# Chem 261
# Assignment & Lecture Outline 3:
# Stereochemistry, Alkyl Halide Substitution ($S_N1$ & $S_N2$)

## Read

*Organic Chemistry*, Solomons, Fryle & Snyder 12th Edition (Electronic)

- Functional Group List – Learn to recognize – Please see Green Handout – also p 76 of text
- Periodic Table – Inside Front Cover - know 1st 10 elements (up through Neon)
- Relative Strength of Acids and Bases – Inside Front cover (reference only)
- Chapter 5 – Stereochemistry
- Chapter 6 –Ionic Reactions: Nucleophilic Substitution of Alkyl Halides

## Problems:

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

- **Chapter 5:** 5.1 to 5.15; 5.18 to 5.21; 5.26; 5.28; 5.33a-d; 5.46
- **Chapter 6:** 6.1 to 6.5; 6.7 to 6.10; 6.13; 6.20; 6.26; 6.27

## Lecture Outline # 3

I. **Comparison of 2 Structures:**

Same Molecular Formula ? -> If Yes, Possibly Isomers or Identical
Same Arrangement (Sequence) of Groups ?
If No -> Structural Isomers
If Yes -> Superposable?
If Yes -> Identical Structures
If No -> Stereoisomers
Non-Superposable Mirror Images ?
If NO -> Diastereomers
If Yes -> Enantiomers

II. **Chirality and Stereoisomers**

A. The Concept of Chirality
1. Identification of chiral objects
a) achiral = not chiral
b) planes of symmetry within a molecule
2. Types of stereoisomers – enantiomers and diastereomers

B. Location of stereogenic (chiral) centres – 4 different groups on tetrahedral atom
1. Enantiomers & diastereomers
2. Meso compounds - chiral centers with plane of symmetry within molecule
3. Molecules with more than one chiral centre
4. Recognition of chiral centers in complex molecules - cholesterol - 8 chiral centres
Drawing the enantiomer of cholesterol and its potential 255 stereoisomers
5. Fischer projections

C. R and S nomenclature
    1. Rules for Assigning R and S configurations
    2. Treatment of multiple bonds

III. **Optical Rotation, Optical Purity, and Resolution of Enantiomers**

A. Optical Rotation
    1. Measurement, factors, and absolute rotation
    2. Optical purity and enantiomeric excess
    3. Physical Properties of Enantiomers and Diastereomers
    4. Racemic mixtures - 50-50 mixtures of enantiomers
    5. Optical Purity = enantiomeric excess (ee)

B. Separation (Resolution) of Enantiomers (e.g. Racemic mixtures)
    1. Creation of diastereomers
    2. Biological recognition

IV. **Nucleophilic Substitution Reactions ($S_N1$ and $S_N2$)**

A. General Features of Nucleophilic Substitution vs. Elimination Reactions
    1. Definitions: $S_N1$ and $S_N2$
    2. Mechanisms

B. $S_N2$ Reactions
    1. Stereochemistry - Walden Inversion (inversion of configuration)
    2. Substitution of Primary and Secondary Alkyl Halides
    3. Synthesis of alcohols, ethers, other halides, etc.

C. $S_N1$ Reactions
    1. Stereochemical Aspects (loss of stereochemistry via carbocations)
    2. Substitution of Tertiary Alkyl Halides and Other Tertiary Carbons
    3. Synthesis of alcohols, ethers, halides