

**Chem 164/261**  
**Assignment & Lecture Outline 5:**  
**Alcohols, Ethers and Introduction to Carbohydrates**

---

**Read**

TWG Solomons and CB Fryhle "Organic Chemistry" 11e Edition (2014)

- Functional Group List (see Handout) and (Periodic Table (Inside Front Cover)
- Chapter 6 – Substitution Reactions (re-read alcohols from alkyl halides)
- Chapter 8 – Alkenes (re-read alcohols and ethers from alkenes)
- Chapter 11 – Alcohols and Ethers
- Chapter 21 – Phenols (read for overview sections 21.1 – 21.5 only)
- Chapter 22 – Carbohydrates (read sections 22.1 – 22.4 and sections 22.12 – 22.13)

**Problems**

Do **Not** turn in, answers available in "Study Guide and Solutions Manual for Organic Chemistry" for Solomons. This is available in the Bookstore

- **Chapter 11:** review practice & solved problems 11.25 to 11.28; 11.32
- **Chapter 22:** 22.1; 22.2; 22.6; 22.20 (a, b, c, h, i, j, k, l, p, q, r)

**Lecture Outline #5**

**I. Structure and Nomenclature of Alcohols and Ethers**

A. Aliphatic Alcohols

1. IUPAC system
2. Common names – carbinol system, "alcohol" names

B. Aromatic Alcohols (Phenols)

C. Ethers

1. Common names
2. IUPAC system – "alkoxy"

**II. Physical Properties**

A. Alcohols and Phenols – general properties

1. MP, BP, solubility, density – hydrogen bonding
2. Acidity of aliphatic alcohols (ROH) and ArOH

B. Physical Properties of Ethers

### III. Preparation of Alcohols and Phenols (*Review – Previously Discussed in Class*)

- A. From Alkenes – Aliphatic Alcohols (ROH)
  - 1. Hydration ( $\text{H}_2\text{O}$ ,  $\text{H}^+$ )
  - 2. Oxymercuration – Demercuration [ $\text{Hg}(\text{OAc})_2$  then  $\text{NaBH}_4$ ]
  - 3. Hydroboration – Oxidation [ $\text{B}_2\text{H}_6$  then  $\text{H}_2\text{O}_2$ ,  $\text{KOH}$ ]
- B. By Nucleophilic Substitution Reactions ( $\text{S}_{\text{N}}1$  and  $\text{S}_{\text{N}}2$ )
  - 1. Definitions:  $\text{S}_{\text{N}}1$  and  $\text{S}_{\text{N}}2$
  - 2. Mechanisms
- C.  $\text{S}_{\text{N}}2$  Reactions
  - 1. Stereochemistry – Walden Inversion (inversion of configuration)
  - 2. Substitution of primary and secondary alkyl halides
- D.  $\text{S}_{\text{N}}1$  Reactions
  - 1. Stereochemical Aspects (loss of stereochemistry via carbocations)
  - 2. Substitution of tertiary alkyl halides and other tertiary carbons
  - 3. Synthesis of alcohols, ethers

### IV. Reactions of Alcohols and Phenols –

- A. Reactions Breaking O–H Bond
  - 1. Acid–base – alcohols as acids
  - 2. Ester formation **WILL NOT BE COVERED - WILL NOT BE ON EXAM**
  - 3. Ether formation
  - 4. Oxidation **WILL NOT BE COVERED - WILL NOT BE ON EXAM**
- B. Reactions Breaking C–O Bond
  - 1. Dehydration to alkenes (reverse of water addition to alkenes)
  - 2. Formation of alkyl halide (substitution reactions)

### V. Ethers (*Review – Previously Discussed in Class*)

- A. Preparation
  - 1. Mercuration – Demercuration of alkenes in alcohols
  - 2. Epoxidation of alkenes
  - 3. From alcohols by removal of  $\text{H}_2\text{O}$
  - 4. From alkyl halides or sulfonates
- B. Reaction of Ethers
  - 1. Cleavage of ethers to alcohols

### VI. Carbohydrates

- A. Monosaccharides
  - 1. Classification – aldose, ketose, triose, tetrose, etc...
  - 2. Stereoisomerism
  - 3. Anomers and ring formation (hemiacetals, acetals)
  - 4. Properties and sweet taste
- B. Disaccharides and Polysaccharides
  - 1. Sucrose
  - 2. Cellulose, starch, glycogen