Chapter 8 – Reactions of Alcohols, Ethers, and Thiols

This chapter covers three functional groups.

Alcohols, ROH, undergo all sorts of reactions, but most of these tie in with reactions that you have already studied: acid-base in chapter 2, alkene hydration in chapter 5, nucleophilic aliphatic substitution in chapter 7, and β-elimination in chapter 7. These tie-ins illustrate the close interconnections that often exist between seemingly diverse phenomena.

Ethers, ROR', are generally unreactive, particularly towards nucleophiles, bases, and oxidizing agents. Epoxides provide an important exception to this rule.

Thiols, RSH, undergo diverse reactions, but you do not have to learn any beyond what was already covered in chapter 7.

After you finish studying this chapter, you should be able to do the following:

1 Write and interpret IUPAC names for alcohols, ethers, and thiols

- Sample problems: 8.12-8.16
- Key background:
  - alkanol (8.2B) {common: alkyl alcohol}
  - alkoxyalkane (8.4B) {common: alkyl alkyl ether}
  - alkanethiol (8.6B) {common: alkyl mercaptan}

2 Predict the *relative* boiling points of organic molecules
3 Predict the *relative* water solubility of organic molecules
4 Predict the *relative* stability of conformational isomers

- Sample problems: 8.17-8.24
- Key background:
  - dispersion forces (3.9B) {bp & solubility}
  - hydrogen bonding {bp, solubility, conformation}
  - torsion strain (3.7A) {conformation}
  - steric strain (3.7B) {conformation}

5 Predict the *relative* acidity of alcohols & thiols; predict the *relative* basicity of their conjugate bases

- Sample problems: 8.27-8.31
- Key background:
  - *relative* pK_a's of carboxylic acids, alcohols & thiols

For chapter 8 reactions: 1) if a reaction is marked **[Iso]** also draw all *expected* product stereo- or regioisomers, 2) if a reaction is marked **[Mech]**, also draw a step-by-step mechanism using curved arrows to show all electronic changes

6 Recognize 1^o, 2^o, and 3^o alcohols

7 Draw the organic product(s) of a chemical reaction between an alcohol and the reagents list below

- **[Iso, Mech] HBr or HCl (substitution of OH, 8.3D)**
- **$SOCl_2$ (substitution of OH, 8.3D)**
- **[Iso, Mech] H_2SO_4 or H_3PO_4 (elimination of OH, 8.3E)**
- **H_2CrO_4 (oxidation, 8.3F)**
- **$K_2Cr_2O_7$, H_2SO_4 (oxidation, 8.3F)**
- **PCC – pyridinium chlorochromate (oxidation, 8.3F)**
- **Na metal (deprotonation, 8.3C)**
- **[Iso, Mech] base + haloalkane (substitution of halogen by RO^-, ch. 7)**
- **[Iso, Mech] alkene + acid catalyst (addition of ROH to alkene, ch. 5)**

- Sample problems: 8.22-8.39
- Key background:
  - nucleophilic aliphatic substitution (7.4-7.7)
  - β-elimination (7.8-7.9)
  - hydration of alkenes (5.3B)

8 Draw the organic product of these reactions:

- **[Iso] alkene + peroxycarboxylic acid (8.5B)**
- **[Iso] epoxide + aqueous acid (8.5C)**
- **[Iso] epoxide + amine (8.5C)**

- Sample problems: 8.37f, 8.40c, 8.42h, 8.43c, 8.44d-f, 8.46
- Key background:
  - Compare products (including stereochemistry) from "epoxide + aqueous acid" and "alkene + OsO_4"

9 Complete a *partial* reaction recipe by filling in a missing reactant, reagent, or product as needed

10 Given a "convert A into B" problem that cannot be accomplished with a single reagent, draw another compound C that can be used as follows: A→ C → B

- Sample problems: 8.40-8.47
- Key background: