Key Concepts:

- Understand the reaction pathway taken by alcohols, epoxides, and ethers
- Become comfortable with transferring the substitution and elimination reaction concepts ($S_n1$, $S_n2$, E1 and E2) to alcohols, ethers and epoxides

Chapter 9

1. What three alkenes are formed when $CH_3CH_2CH_2CH(OH)CH_3$ is treated with $H_2SO_4$? Label the major product (9.50 third edition)?

2. Sometimes carbocation rearrangements can change the size of a ring. Draw a stepwise, detailed mechanism for the following reaction. (9.57 third edition)

3. Identify the reagents (a-h) needed to carry out each reaction. (9.78 third edition)
4. Explain why the treatment of anisole with HBr yields phenol with $\text{CH}_3\text{Br}$, but not bromobenzene (9.34 third edition).
5. Draw the products of each reaction, and indicate the stereochemistry where appropriate.

(9.75 third edition)

\[\text{H}_3\text{C} \quad \text{H} \quad \text{HBr} \]

\[\text{a.} \quad \text{HO} \]

\[\text{b.} \quad \text{H}_3\text{CH}_2\text{C} \quad \text{C} \quad \text{H}_2\text{CH}_3 \quad 1. \text{NaCN} \quad 2. \text{H}_2\text{O} \]

\[\text{c.} \quad \text{HO} \quad 1. \text{TsCl} \quad \text{CH}_3\text{CO}_2^- \quad \text{pyridine} \]

\[\text{d.} \quad \text{HO} \quad \text{NaH} \quad \text{CH}_3\text{CH}_2\text{I} \]

6. Epoxides are converted to allylic alcohols with nonnucleophilic bases such as lithium diethylamide [LiN(CH\(_2\)CH\(_3\))\(_2\)]. Draw a stepwise mechanism for the conversion of 1,2-epoxycyclohexane to 2-cyclohexen-1-ol with this base. Explain why a strong bulky base must be used in this reaction. (9.81 third edition)

\[\text{a.} \quad \text{1. LiN(CH}_2\text{CH}_3)_2 \quad \text{HN(CH}_2\text{CH}_3)_2 \quad \text{LiOH} \]

\[\text{b.} \quad \text{2. H}_2\text{O} \quad \text{OH} \]
7. 1,2-Diols are converted to carbonyl compounds when treated with strong acids, in a reaction called the pinacol rearrangement. Draw a stepwise mechanism for this reaction.

(9.83 third edition)

a. 

\[
\begin{align*}
\text{HO} & \quad \text{OH} \\
\text{H}_2\text{SO}_4 & \quad \rightarrow \\
\text{O} & \\
\end{align*}
\]

Chapter 10

8. Draw all stereoisomers formed in each reaction.

\[
\begin{align*}
a. & \quad \text{Br}_2 \\
\text{H}_2\text{O} & \quad \rightarrow \\
b. & \\
\end{align*}
\]
9. Draw a stepwise mechanism for the following reaction.

10. Draw a stepwise mechanism for the conversion of hex-5-en-1-ol to the cyclic ether A.

11. Less stable alkenes can be isomerized to more stable alkenes by treatment with strong acid. For example, 2,3-dimethylbut-1-ene is converted to 2,3-dimethylbut-2-ene when treated with H2SO4. Draw a stepwise mechanism for this isomerization process.

12. Explain why the addition of HBr to alkenes A and C is regioselective, forming addition products B and D, respectively.
13. Devise a synthesis of each product from the given starting material. More than one step is required.

a. 

\[
\text{CH}_3\text{CHCH}_2\text{CH}_2\text{OH} \rightarrow \text{CH}_3\text{CHCH}_2\text{CH}_2\text{OH}
\]

b. 

\[
\text{Br} \rightarrow \text{CH}_3\text{CHCH}_2\text{CH}_2\text{OCH}_3
\]

c. 

\[
\text{I} \rightarrow \text{CH}_3\text{CHCH}_2\text{CH}_2\text{Cl}
\]

d. 

\[
\text{C}_{10} \rightarrow \text{C}_7
\]

e. 

\[
\text{Br} \rightarrow \text{CH}_3\text{CHCH}_2\text{CH}_2\text{C}_2\text{H}_4
\]

f. 

\[
\text{Cl} \rightarrow \text{C}_5\text{H}_9\text{O}
\]