Week 5 Worksheet

Topics Covered:
- Tosylates
  - Reactions with Bases and Nucleophiles
- Ethers
  - Cleavage by Strong Acids
- Epoxides
  - Ring-opening
- Degrees of Unsaturation
- Alkenes
  - Hydrohalogenation
  - Hydration

1. Draw the products of each reaction, and include the stereochemistry at any stereogenic center in the products.

a. 

\[
\begin{align*}
\text{OTs} & \quad + \quad \text{CN} \\
\end{align*}
\]

b. 

\[
\begin{align*}
\text{OTs} & \quad + \quad \text{K}^+ \cdot \text{OC(CH}_3\text{)}_3 \\
\end{align*}
\]

c. 

\[
\begin{align*}
\text{OTs} & \quad + \quad \text{SH} \\
\end{align*}
\]

(Smith 5th ed. Problem 9.25)
2. What alkyl halides are formed when each ether is treated with HBr?

a. 

b. 

c. 

(Smith 5th ed. Problem 9.28)
3. For each of the following reactions, predict the major product and draw a mechanism for its formation:

a.  

b.  

b.  

(Klein 4th ed. Problem 13.16 and 13.18)
4. Calculate the degrees of unsaturation for each of the following compounds.
   a. $\text{C}_5\text{H}_{10}\text{O}_2$
   
   b. $\text{C}_2\text{H}_3\text{N}$
   
   c. $\text{C}_{100}\text{H}_{100}\text{Cl}_2\text{O}_{16}$

   (Klein 4th Ed., Question 14.30)

5. Draw a mechanism for each of the following transformations.

   a. $\begin{array}{c}
   \text{Cyclohexane} \\
   \text{Dilute HCl} \\
   \end{array} \rightarrow \begin{array}{c}
   \text{Cyclohexyl chloride}
   \end{array}$

   (Klein 4th Ed., Question 8.10 & 8.14)

   b. $\begin{array}{c}
   \text{Cyclopentene} \\
   \text{H}_3\text{O}^+ \\
   \end{array} \rightarrow \begin{array}{c}
   \text{Bicyclo[2.2.1]heptane}
   \end{array}$