1. Propose a mechanism.
2. Propose a mechanism.

\[
\begin{align*}
\text{HO-} & \quad \text{OH} \\
\xrightarrow{\text{H}_3\text{O}^+} & \quad \text{O} \\
\end{align*}
\]

\[
\text{HO-} \quad \text{OH} \\
\xrightarrow{\text{H}^+ \text{O}_2H} & \quad \text{O}^+ \quad \text{H}_2\text{O} \\
\]

\[
\begin{align*}
\text{HO-} & \quad \text{OH} \\
\xrightarrow{\text{H}_3\text{O}^+} & \quad \text{O} \\
\end{align*}
\]
3. Give the major product of the following reactions.

\[
\begin{align*}
&\text{CH}_3\text{CH}_2\text{OH} \xrightarrow{\text{HBr}} \text{CH}_3\text{CH}_2\text{ON}_2\text{H} \\
&\xrightarrow{} \text{H}_2\text{O} \xrightarrow{} \text{CH}_3\text{CH}_2\text{OH}
\end{align*}
\]

\[
\begin{align*}
&\text{C}_6\text{H}_{11}\text{OH} \xrightarrow{\text{HCl}} \text{C}_6\text{H}_{11}\text{H}^+
\end{align*}
\]

\[
\begin{align*}
&\text{HO} \xrightarrow{\text{H}_2\text{SO}_4} \text{HO}^+
\end{align*}
\]
4. Give the major product of the following reactions.

\[
\begin{align*}
\text{OH} & \quad \xrightarrow{\text{H}_2\text{SO}_4} \quad \text{+} \quad \xrightarrow{} \quad \text{+} \\
\text{C}_4\text{H}_8 & \quad \xrightarrow{1. \ \text{NaBH}_4} \quad \text{CH}_3\text{CHO} \quad \xrightarrow{2. \ \text{H}_2\text{O}, \ \text{pH}7} \quad \text{CH}_3\text{COCH}_3
\end{align*}
\]

\[
\begin{align*}
\text{CH}_3\text{OH} & \quad \xrightarrow{\text{S}_2\text{Cl}_2} \quad \text{CH}_3\text{CH}_2\text{OTs} \quad \xrightarrow{\text{Cl}^-} \quad \text{CH}_3\text{CH}_2\text{Cl}
\end{align*}
\]
5. Give the major product of the following reaction.

\[
\begin{align*}
  &\text{phenylethynyl} & \xrightarrow{1. \text{CH}_3\text{MgBr}} & \text{alkenyl} \\
  & & \xrightarrow{2. \text{H}_2\text{O workup}} & \text{alkyl} \\
  & & \xrightarrow{3. \text{H}_2\text{O workup}} & \text{alkyl} + \text{H}^+ \\
\end{align*}
\]

6. Outline a multistep synthesis for the following transformation.

\[
\begin{align*}
  &\text{alkyl-CH}_2\text{OH} & \xrightarrow{1. \text{RC} & \text{Cl}} & \text{alkyl-CH} \equiv \text{CO} \\
  & & \xrightarrow{2. \text{H}_2\text{O}} & \text{alkyl-CH}_2\text{OH} \\
\end{align*}
\]
7. Outline a multistep synthesis for the following transformation.

\[ \begin{align*}
\text{[Starting material]} & \xrightarrow{\text{BBr}_3, \text{H}_2\text{O}_2} \text{[Intermediate]} & \xrightarrow{\text{CCl}_4} & \text{[Final product]} \\
\end{align*}\]
8. Outline a multistep synthesis for the following transformation.
9. Outline a multistep synthesis for the following transformation.
10. Outline a multistep synthesis for the following transformation.