1. (6 pts. each) Predict the organic products for the following reactions. Remember to indicate the stereochemistry of the products where appropriate.

a. 

\[
\begin{array}{c}
\text{O} \\
\text{H} \\
\text{H} \\
\text{B} \\
\text{r} \\
\end{array}
\]

b. 

\[
\begin{array}{c}
\text{O} \\
\text{H} \\
P \\
\text{B} \\
\text{r} \\
\end{array}
\]

c. 

\[
\begin{array}{c}
\text{O} \\
\text{H} \\
\text{C} \text{l} \\
\end{array}
\]

d. 

\[
\begin{array}{c}
\text{O} \\
\text{H} \\
\text{N} \\
\text{C} \text{l} \\
\text{S} \\
\text{O} \\
\text{C} \text{H}_3 \\
\end{array}
\]

1. _______

2. _______

3. _______

4. _______

5. _______

6. _______

2. (6 pts. each) Predict the organic products for the following reactions. Remember to indicate the stereochemistry of the products where appropriate.

a. 

\[
\begin{array}{c}
\text{H}_2\text{S} \\
\text{O} \\
\text{H} \\
\end{array}
\]

b. 

\[
\begin{array}{c}
\text{O} \\
\text{H} \\
P \\
\text{C} \text{l} \\
\text{N} \\
\end{array}
\]

1. _______

2. _______

3. _______

4. _______

5. _______

6. _______
3. (8 pts. each) Propylene oxide reacts with ethanol and ethoxide as indicated in reactions i and ii respectively.

\[ \text{O} \text{H} \text{H} \text{O} \]

\[ \text{H}^+ \text{catalyst} \]

\[ \text{ii.} \]

\[ \text{O} \text{O} \]

\[ 1. \text{H}_2\text{O, dilute H}^+ \]

Explain the regioselectivity of the two reactions. Remember, reaction i. is believed to occur via an acid catalyzed mechanism.

4. (8 pts. each) The reaction of 1 equivalent of HBr with 2-methoxy-2-methylpropane produces methanol and 2-bromo-2-methylpropane.

a. Explain the mechanism of the reaction (the role of the H\(^+\) and the role of the Br\(^-\)).

b. Explain why these products are seen instead of methyl bromide and 2-methyl-2-propanol.
5. (8 pts. each) From an alkoxide and an alkyl halide, make the following ethers.
   a. 
   ![Chemical structure]
   b. 
   ![Chemical structure]
   c. 
   ![Chemical structure]

6. (8 pts. ea.) Synthesize the following compounds from the indicated starting materials and any other reagents needed.
   a. 
   ![Chemical transformation]
   b. 
   ![Chemical transformation]