1. (8 pts) Name the following compounds.

   a) 
   
   b) 
   
   c) 
   
   d) 

2. (8 pts) Calculate the degrees of unsaturation and draw one isomer corresponding to the following molecular formulas.

   a) C_4H_7Br
   
   b) C_4H_7N

3. (10 pts) Write the mechanism for the following reaction.

   
   + Br^−
4. (9 pts) Each of the following reactions give only one elimination product. Draw the structure and explain why only one product is isolated.

a) 

\[
\text{Br} \quad \xrightarrow{\text{NaOH}}
\]

b) 

\[
\text{Br} \quad \xrightarrow{\text{OH}}
\]

c) 

\[
\text{Br} \quad \xrightarrow{\text{NaOH}}
\]

5. (10 pts) Fill in the missing reagents for the two reactions.

\[
\text{1} \quad \xrightarrow{\text{1}} \quad \text{OH}
\]

\[
\text{2} \quad \xrightarrow{\text{2}} \quad \text{OH}
\]

6. (10 pts) Suggest a possible synthesis of the following product by starting with an alkyne and an alkyl halide. Write all reactants and reagents.

\[
\text{Cyclopentyl propyne}
\]
7. (12 pts) Predict the products of the following reactions. Show all stereochemistry where appropriate.

\[
\begin{align*}
\text{NaNH}_2 & \quad \text{H}_3C &= \text{H} \\
\text{O} & \quad \text{H}_3C &= \text{CH}_3 \\
\text{1. Na/NH}_3 & \quad H_2\text{Pd/BaSO}_4 \\
\text{2. H}_2O & \quad \text{H}_2\text{SO}_4 \\
\end{align*}
\]

8. (12 pts) Provide the reagents necessary to complete the following transformation. The reaction takes more than one step. Show each intermediate in your reaction scheme.

\[
\begin{array}{c}
\text{Br} \\
\text{OH} \\
\end{array}
\quad \rightarrow 
\begin{array}{c}
\text{OH} \\
\text{OH} \\
\end{array}
\]

9. (10 pts) The two sets of reagents below give two different structural isomers with the same molecular formula. For each of the reagents below write the product and explain why that product is favored.

\[
\begin{align*}
\text{H}^+, \text{H}_2\text{O} & \quad \text{C}_6\text{H}_{13}\text{OH} \\
\text{1. Hg(OAc)}_2, \text{H}_2\text{O} & \\
\text{2. NaBH}_4 & \\
\end{align*}
\]
10. (12 pts) For each reaction below replace X with the missing reactant, reagents, or product.

a) 
\[ X \overset{1. O_3}{\rightarrow} \overset{2. (CH_3)_2S}{\rightarrow} \text{HCO}_2 \text{H} + \text{CO}_2 \]

b) 
\[ \begin{array}{c} \text{CH}_2=\text{CH}_2 \\ \text{Pt} \end{array} \overset{2 \text{ equiv. H}_2}{\rightarrow} X \]

c) 
\[ \begin{array}{c} \text{C}_7\text{H}_8 \\ X \end{array} \overset{}{\rightarrow} \text{C}_7\text{H}_8 \text{Br} \]

d) 
\[ \begin{array}{c} X \\ \text{H}_2\text{O}_2 \end{array} \overset{\text{OsO}_4}{\rightarrow} \text{C}_5\text{H}_10 \text{OH} \]

11. (8 pts) For each pair circle the more stable compound.

a) 
\[ \begin{array}{c} \text{OH} \\ \text{CH}_3\text{CH}=\text{CH}_2 \end{array} \]

b) 
\[ \begin{array}{c} \text{CH}_3\text{CH}=\text{CH}_2 \\ \text{C}_5\text{H}_10 \text{Br} \end{array} \]

c) 
\[ \begin{array}{c} \text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2 \\ \text{C}_5\text{H}_10 \text{OH} \end{array} \]

d) 
\[ \begin{array}{c} \text{CH}_3\text{CH}=\text{CH}_2 \\ \text{C}_5\text{H}_10 \text{Br} \end{array} \]