1. Predict the major products of the following reactions.
   a) Cyclopentanol + H₂SO₄/heat

   b) Product from above + OsO₄/H₂O₂ (optional: followed by HIO₄)

   c) (R) – 2- butanol + TsCl in pyridine

   d) (R) – 2-butyl tosylate + NaBr

2. Show how you will make each of the following compounds from an alcohol of your choice.
   a) 
      ![Image]

   b) 
      ![Image]

   c) 
      ![Image]

   d) 
      ![Image]
3. What simple chemical test can you use to distinguish between the following pairs of compounds? Write the test and the observation.
   a) 1-butanol and 2-butanol
   b) 2-butanol and 2-methyl-2-butanol
   c) Cyclohexanol and cyclohexene

4. How will you synthesize the following compound from compounds of 6 carbons or less?

5. Show how you would carry out the following conversions.
   a) 
   b) 
   c) 
   d)
6. Show how you would synthesize the following compounds using alcohols of 4 or less carbons and any other reagents of your choice.

a)

b)

c)

d)

e)

f)
7. Compound A is an optically active alcohol. Treatment with chromic acid converts A to a ketone B. In a separate reaction A is treated with PBr₃, converting A to C. Compound D is purified and reacted with magnesium and ether. Compound B is added to the resulting solution of the Grignard reagent. After hydrolysis, this solution is found to have 3,4-dimethyl-3-hexanol. Propose the structures for A, B, C and D.

\[
\begin{align*}
\text{PBr}_3 & \rightarrow \text{Mg, ether} \rightarrow \text{C} \rightarrow \text{Grignard Reagent} \rightarrow \text{D} \rightarrow 3,4\text{-dimethyl-3-hexanol} \\
\text{Na}_2\text{Cr}_2\text{O}_7, \text{H}_2\text{SO}_4 & \rightarrow \text{B}
\end{align*}
\]

8. Determine the structures A through G in the following scheme.

\[
\begin{align*}
\text{C}_6\text{H}_10\text{O} & \overset{1) \text{CH}_3\text{Mgl}}{\longrightarrow} \text{C}_6\text{H}_{12}\text{O} \overset{2) \text{H}_3\text{O}^+}{\longrightarrow} \text{A} \\
& \overset{\text{H}_2\text{SO}_4}{\longrightarrow} \text{B} \overset{\text{H}_2, \text{Pd}}{\longrightarrow} \text{C} \\
\text{C}_{10}\text{H}_{18} & \overset{\text{H}_2\text{SO}_4}{\longrightarrow} \text{heat} \rightarrow \text{C}_6\text{H}_{12}\text{O} \overset{1) \text{CH}_3\text{Mgl}}{\longrightarrow} \text{D} \\
& \overset{2) \text{H}_3\text{O}^+}{\longrightarrow} \\
\text{C}_{10}\text{H}_{18} & \overset{1) \text{Mg, ether}}{\longrightarrow} \text{C}_9\text{H}_8\text{Br} \overset{\text{HBr}}{\longrightarrow} \text{HBr} \\
& \overset{\text{PhCO}_3\text{H}}{\longrightarrow} \text{C}_6\text{H}_6\text{O}
\end{align*}
\]