1. Give a single organic product for each of the following reactions unless otherwise indicated. Clearly show stereochemistry where appropriate. Please circle your answer. (8 pts each, 104 pts total)

\[
\begin{align*}
\text{H}_3\text{C} & \quad \text{O} \quad \text{K}^+ \\
\text{H}_3\text{C} & \quad \text{CH}_3 \\
\text{H}_3\text{C} & \quad \text{O} \quad \text{K}^+ \\
\text{H}_3\text{C} & \quad \text{CH}_3 \\
\end{align*}
\]

\[
\begin{align*}
\text{H}_3\text{C} & \quad \text{CH}_3 \\
\text{H}_3\text{C} & \quad \text{O} \quad \text{K}^+ \\
\text{H}_3\text{C} & \quad \text{CH}_3 \\
\end{align*}
\]

Two diastereomeric products
1. BH₃·THF
2. H₂O₂, NaOH

CH₃
\[ \text{H} \]
\[ \text{CH₃} \]
\[ \text{CH₃} \]
\[ \text{H} \]

1. H₂O₂, NaOH
2. NaBH₄, NaOH

H₂N
\[ \text{CH₂} \]
\[ \text{CH₂} \]
\[ \text{Br} \]
\[ \text{H₂O} \]
\[ \text{HO}^- \]

H₂N
\[ \text{CH₂} \]
\[ \text{CH₂} \]
\[ \text{Br} \]
\[ \text{H₂O} \]
\[ \text{HO}^- \]

C₁₁H₁₄O₂

(catalytic amount)

C₄H₉N

3
2. Provide for a synthesis of cis-1,2-dimethylcylopentane (2) from alcohol 1. (16 pts)
3. Write a detailed mechanism (including all protonation and deprotonation steps) for the acid-promoted hydration of alkene 3 to alcohol 4. (16 pts)
4. Hydrogenation of compound A \((C_{10}H_{16})\) provides 1-isopropyl-4-methyl cyclohexane \((7)\). Ozonolysis of A liberates one equivalent of formaldehyde \((5)\) and diketoaldehyde \((6)\). Propose a structure for A that is consistent with this data. (16 pts)
5. Treatment of trans-1-iodo-2-methylcyclohexane 8 with potassium tert-butoxide leads to the non-Saytseff alkene product 9. Draw clear pictures of the two possible chair conformations of 8, and use these to carefully explain why the reaction does not follow Saytseff’s rule. (16 pts)
6. Propose a detailed mechanism for the cyclization of diene 10 to cyclohexene 11. (16 pts)
7. Provide a synthesis of dibromide 13 from terminal alkyne 12. (16 pts)