1. (12) Name the following compounds:

a) ![Chemical structure](image)

b) ![Chemical structure](image)

c) ![Chemical structure](image)

d) ![Chemical structure](image)

e) ![Chemical structure](image)

2. (8) Draw the following compounds. Be sure to show stereochemistry where appropriate:

a) 
\((E)\) 2,3-dimethyl-3,4-epoxyhexane

b) 4,5-dichloro-2-isopropyl-3-cyclopentenone

3. (10) A chemist attempted to synthesize t-butyl propyl ether by treating t-butyl chloride with potassium propoxide as shown below. A reaction occurred but gave none of the desired product. Instead she isolated a compound with a formula of \(\text{C}_4\text{H}_8\) and an alcohol. Explain what happened (show what \(\text{C}_4\text{H}_8\) is and how it forms – show the mechanism). How should she design her reaction in order to isolate the ether?

\[
\text{CH}_3\text{CH}_2\text{CH}_2\text{O}^-\text{K}^+ + \text{CH}_3\text{CH}_2\text{CCl} \xrightarrow{\text{desired}} \text{CH}_3\text{CH}_2\text{CH}_2\text{OCCCH}_3 \\
\text{none formed} \quad \text{CH}_3\text{CH}_2\text{CH}_2\text{OCCCH}_3 \\
\text{actual} \quad \text{CH}_3\text{CH}_2\text{CH}_2\text{CCl} \\
\text{C}_4\text{H}_8 + \text{an alcohol}
\]

draw the reaction she should have run here
4. (40) Give the major product for each of the following reactions.

a) ![Structure](image1) \[\text{2 mol equiv. MCPBA in CH}_2\text{Cl}_2\]

b) ![Structure](image2) \[\text{SOCl}_2 \text{ in pyridine}\]

c) ![Structure](image3) \[\text{CrO}_3, \text{H}_2\text{SO}_4 \text{ in acetone}\]

d) ![Structure](image4) \[\text{1) Mg, ether} \]
\[\text{2) CH}_3\text{CH}_2\text{CH}_2\text{CH}_3 \text{Cl}\] \[\text{3) H}_3\text{O}^+ \text{ workup}\]

e) ![Structure](image5) \[\text{1) NaH} \]
\[\text{2) CH}_3\text{CH}_2\text{I}\]

f) ![Structure](image6) \[\text{1) CH}_3\text{SO}_2\text{Cl, pyridine} \]
\[\text{2) NaOH, DMSO}\]

g) ![Structure](image7) \[\text{1) Hg(OAc)}_2, \text{methanol} \]
\[\text{2) NaBH}_4\]

h) ![Structure](image8) \[\text{1) KOCH}_2\text{CH}_3 \text{ in ethanol} \]
\[\text{2) H}_3\text{O}^+\]

i) ![Structure](image9) \[\text{1) LiAlH}_4 \]
\[\text{2) H}_3\text{O}^+\]

j) ![Structure](image10) \[\text{PCC in CH}_2\text{Cl}_2} \]
\[(\text{pyridinium chlorochromate)}\]
5. (10) Starting with alcohols of 5 carbons or less as your only source of carbon and any other reagents, show how the following alcohol could be prepared.

\[
\text{CH}_2\text{CH}_3 \quad \text{COH} \quad \text{CH}_3
\]

6. (14) Provide the reagents necessary (in the proper order) to carry out the following reactions:

a) \[
\begin{array}{c}
\text{O} \\
\text{CH}_2\text{OH}
\end{array}
\quad \rightarrow 
\begin{array}{c}
\text{Cl} \\
\text{O}
\end{array}
\]

b) \[
\begin{array}{c}
\text{O} \\
\text{CH}_3
\end{array}
\quad \rightarrow 
\begin{array}{c}
\text{O} \\
\text{CH}_3
\end{array}
\]

7. (10) Propose clear mechanism to account for the following transformations. Use only the reagents provided, show all intermediates and indicate electron flow with arrows.

\[
\begin{array}{c}
\text{Br} \\
\text{O}
\end{array}
\quad \xrightarrow{\text{Na}^+\text{H}^-} 
\begin{array}{c}
\text{O} \\
\text{CCH}_3
\end{array}
\]

*denotes a C-13 label
8.(8) A student attempted to carry out a Grignard reaction of the ketone shown below in the attempt of isolating the 3° alcohol shown. Instead, she synthesized a 2° alcohol and the ketone was still intact. Explain. Propose structure for the product of the reaction.

![Chemical structure of the ketone and the Grignard reaction](image)

9.(14) Propose a sequence of chemical steps in the proper order that facilitates the following transformations.

a) ![Chemical structure of the transformation](image)

b) ![Chemical structure of the transformation](image)