This is an open-book, open notes exam. Please show your work in detail.

1. (20 points) Draw the structures of B and C. You do not have to show mechanisms, but you do need to show stereochemistry clearly.

\[ A \xrightarrow{\text{MCPBA}} B \xrightarrow{\text{LiAlH}_4} C \]

\[ C_7H_{14}O \rightarrow C_7H_{16}O \]

\[ ^{13}\text{C:} \]
\[ 74.2, \text{ d} \]
\[ 38.3, \text{ t} \]
\[ 31.7, \text{ t} \]
\[ 28.3, \text{ t} \]
\[ 23.5, \text{ t} \]
\[ 14.6, \text{ q} \]
\[ 9.2, \text{ q} \]

2. (20 points) Indicate the expected major product. Explain your reasoning in detail.

a. 

\[ \begin{array}{c}
\text{O} \\
\text{O}
\end{array} \rightarrow 
\begin{array}{c}
\text{O} \\
\text{O}
\end{array} 
\]
3. (20 points) Outline the synthesis steps to convert C into D. In addition to C, you may use any piece that contributes three or fewer carbons to the final product.

\[
\begin{align*}
\text{C} & \quad \xrightarrow{\text{Br}} \quad \text{D}
\end{align*}
\]

4. (20 points) Deduce the structure of E, and draw an arrow-pushing mechanism for the transformation.

\[
\begin{align*}
\text{D} & \quad \xrightarrow{\text{MgBr, } \text{H}^+ / \text{H}_2\text{O work up}} \quad \text{E} \\
\text{CN} & \quad \xrightarrow{\text{MgBr, } \text{H}^+ / \text{H}_2\text{O work up}} \quad \text{E} \\
\end{align*}
\]

\[
\begin{align*}
\text{E} & \quad \text{C}_{9}\text{H}_{18}\text{O} \\
\text{13C NMR} & \quad \text{1H NMR} \\
210.6, \ s & \quad 0.90, \ d, \ J = 7.3 \ Hz, \ 12 \ H \\
52.4, \ t (2) & \quad 2.12, \ m, \ 2H \\
24.5, \ d (2) & \quad 2.24, \ d, \ J = 6.7 \ Hz, \ 4H \\
22.6, \ q (4) & \quad \text{H} \\
\end{align*}
\]
5. (20 points) Draw a detailed arrow-pushing mechanism for the following transformation. 5/20 points for correctly showing the mapping of the starting material onto the product.

You may write this in abbreviated form:

When drawing the mechanism.