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.

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

\[ \begin{align*}
\text{A} & \rightarrow \text{B} : \text{C}_7\text{H}_{14}\text{O} \\
\text{B} & \rightarrow \text{C} : \text{C}_7\text{H}_{16}\text{O}
\end{align*} \]

**13C:**
- 74.2, d
- 38.3, t
- 31.7, t
- 28.3, t
- 23.5, t
- 14.6, q
- 9.2, q

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

a. 

\[ \begin{align*}
\text{H}^+ & \rightarrow \text{Product}
\end{align*} \]

**1H:**
- 6.0, s
- 3.5, t
- 2.2, t
- 1.8, t

**13C:**
- 77.3, d
- 37.8, t
- 31.5, t
- 27.3, t
- 14.6, q
- 9.2, q

I = inverts
S = same
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.

\[
\text{CH}_3\text{Br} \xrightarrow{\text{Mg;}} \text{CH}_3\text{OH} \\
\text{C} \quad \text{D}
\]

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

\[
\text{CH}_3\text{CN} \xrightarrow{\text{MgBr; H}^+ / \text{H}_2\text{O work up}} \text{E} \quad \text{C}_9\text{H}_{18}\text{O} \\
\text{D} \\
\text{E}
\]

\[
\begin{array}{ll}
\text{\textbf{13C NMR}} & \text{\textbf{1H NMR}} \\
210.6, \text{ s} & 0.90, \text{ d, } J = 7.3 \text{ Hz, 12 H} \\
52.4, \text{ t (2)} & 2.12, \text{ m, 2H} \\
24.5, \text{ d (2)} & 2.24, \text{ d, } J = 6.7 \text{ Hz, 4H} \\
22.6, \text{ q (4)} & \\
\end{array}
\]

\[
\begin{array}{ll}
\text{H}^+ & \\
\text{H}_2\text{O} & \text{H}^+ \\
\text{H}^+ & \text{H}^+ \text{ transfer} \\
\end{array}
\]

\[
\text{E} \xrightarrow{H^+} \text{CH}_3\text{CO} + \text{NH}_3 + H^+
\]
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: