1. (10 points) Show a synthetic scheme for converting A into B. As well as A, you may use any piece that contributes three or fewer carbons to the final product.

\[
\begin{align*}
A & \xrightarrow{\text{any piece}} B \\
\end{align*}
\]

2. (10 points) Deduce the structure of D, and draw an arrow-pushing mechanism for its formation.

\[
\begin{align*}
\text{C} \quad & \text{CrO}_3 \quad \text{H}^+ \quad \text{D} \quad \text{C}_{10}\text{H}_{16}\text{O} \\
\text{H} \quad & \text{IR (neat) } 1670 \text{ cm}^{-1} \\
\end{align*}
\]

\[\begin{align*}
\text{\textsuperscript{13}C NMR} & \\
199.7, s & \\
166.5, s & \\
125.4, d & \\
37.7, t & \\
37.3, t & \\
29.6, t & \\
29.0, t & \\
22.7, t & \\
22.3, t & \\
13.8, q & \\
\end{align*}\]

\[\begin{align*}
\text{\textsuperscript{1}H NMR} & \\
5.87 (t, 1H, J = 1.4 \text{ Hz}) & \\
2.35 (ddd, 2H, J = 7.5, 6.7, 2.2 \text{ Hz}) & \\
2.29 (t, 2H, J = 6.1 \text{ Hz}) & \\
2.21 (t, 2H, J = 7.5 \text{ Hz}) & \\
2.05-1.95 (m, 2H) & \\
1.53-1.45 (m, 2H) & \\
1.39-1.29 (m, 2H) & \\
0.92 (t, 3H, J = 7.3 \text{ Hz}) & \\
\end{align*}\]

3. (10 points) Draw and arrow-pushing mechanism for the cyclization of E to F.

\[
\begin{align*}
\text{E} & \xrightarrow{\text{H}^+ \quad - \text{H}_2\text{O}} \Delta \text{F} \\
\end{align*}
\]