1. (4) Which of the following compounds will have the characteristic IR peak at about 1720 cm\(^{-1}\) and four signals in the \(^1H\) NMR spectrum?

\[
\begin{align*}
\text{CN} & \quad \equiv \quad \text{CH}_3\text{CH}_2\text{CH}_2\text{OH} \\
\text{H} & \quad \text{bCl} & \quad \text{Ha} & \quad 3 & \quad \text{Hb} & \quad 5 & \quad \text{Hc} & \quad 7 & \quad \text{Hd} & \quad 2 & \quad \text{He} & \quad 2 \\
\end{align*}
\]

2. (5) Into how many peaks would you expect the \(^1H\) NMR signals of the indicated protons a-e to be split? (put number of peaks corresponding to the signals of Ha-He in each box; 1 pt each)

3. (4) Circle the molecule that is in agreement with the following \(^1H\) NMR spectrum:

4. (3) Circle the correct IUPAC name for compound in the box:

\[
\begin{align*}
\text{cis-2,3-diethyloxirane} & \quad \text{trans-2,3-diethyloxirane} & \quad \text{trans-3,4-diethyloxirane} \\
\text{cis-3,4-diethyloxirane} & \quad \text{trans-3,4-epoxyhexene} & \quad \text{cis-2,3-epoxyhexene} \\
\end{align*}
\]

5. (3) Finish drawing the structure of the product in the following reaction by placing appropriate substituents in the boxes (1 pt each substituent):

\[
\begin{align*}
\text{CH}_3 & \quad \text{CH}_3\text{ONa} & \quad \text{CH}_3\text{OH} & \quad \text{CH}_3 & \quad \text{O} & \quad \text{CH}_3 \\
\text{CH}_3 & \quad \text{OH} & \quad \text{H} & \quad \text{CH}_3 & \quad \text{O} & \quad \text{CH}_3 \\
\end{align*}
\]

6. (6) Place in each box the molecule of a reagent that is required to perform each of the following reactions (2 pts each):

\[
\begin{align*}
\text{OH} & \quad \text{or Na} & \quad \text{or PhCH}_2\text{I} \\
\text{H} & \quad \text{NaH} & \quad \text{PhCH}_2\text{Br} \\
\text{RCO}_2\text{H} & \quad \text{ or } & \quad \text{or} & \quad \text{Ph} \\
\end{align*}
\]

Overall Score: 25