2. Draw the structure (16 points each)

2a. (1R)-2,2-diethylcyclohexanecarboxaldehyde

b. (2S, 4Z)-2-methyl-4-heptenenitrile

3. Give IUPAC names for each molecule (16 points each)

a. 4-hydroxybutanoic acid

b. (2R,3S)-3-bromo-2-butanethiol

c. (2R)-2-bromopropyl (2E,4R)-4-amino-2-pentenoate
4. (20 points each) For each pair of cyclohexanes, which is more stable. Explain your reasoning in detail (no credit for a correct guess, only a correct explanation)

\[ a \]

For both A and B, the favored conformation has the t-Bu groups in the equatorial positions. This places the Et group of A in the equatorial position, and the Et group of B in the axial position.

\[ b \]

For both A and B, the favored conformation has the t-Bu groups in the equatorial positions. A has an axial methyl group, which 'costs' 1.70 kcal (Table 4-3 on pg 142 in V&S). B has an axial bromine, which costs 0.55 kcal/mol. B is more stable.

6. The 'bridgehead' alkene 1 is extremely unstable. Use a clear orbital picture and less than 15 words to explain why. Hint: the answer has to do with the \( \pi \)-bond.

The \( \sigma \) framework holds the p orbitals at a \( \sim 90^\circ \). They cannot overlap and therefore cannot bond.
5. Provide a detailed arrow pushing mechanism for the following reaction

\[ \text{Initiation} \]

\[ \text{Br-atom extraction} \]

\[ \text{multiple bond addition} \]

\[ \text{H-atom extraction} \]
6. The 'bridgehead' alkene 1 is extremely unstable. Use a clear orbital picture and less than 15 words to explain why. Hint: the answer has to do with the $\pi$-bond.

The $\sigma$ framework holds the p orbitals at a $\sim 90^\circ$. They cannot overlap and therefore cannot bond.