1. Identify the most and least shielded protons in each of the following compounds:
   a) \( \text{CH}_3\text{CHCHBr} \)
   b) \( \text{CH}_3\text{CH}_2\text{CH}_2\text{NO}_2 \)
   c) \( \text{CH}_3\text{COCH}_3 \)
   d) \( \text{ClCH}_2\text{CH}_2\text{COCH}_3 \)
   e) \( \text{ClCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{Cl} \)
   f) \( \text{H}_3\text{C}-\text{OCHCH}_3 \)

2. In each of the following compounds, draw a structure and identify the different kinds of nonequivalent protons.
   a) 1-Bromobutane
   b) Butane
   c) 1-Butanol
   d) 1,4-Dibromobutane
   e) 2,2-Dibromobutane
   f) 2,2,3,3-Tetrabromobutane
   g) 1,1,4-Tribromobutane
   h) 1,1,1-Tribromobutane

3. Predict the splitting patterns you would expect for each of the following compounds.
   a) \( \text{Cl}_2\text{CHCH}_2\text{Cl} \)
   b) \( \text{ClCH}_2\text{CH}_2\text{Cl} \)
   c) \( \text{Cl}_3\text{CCHCH}_3 \)
   d) \( \text{ClCH}_2\text{CH}_2\text{OCH}_2\text{CH}_3 \)
   e) \( \text{ClCH}_2\text{CH}_2\text{CH}_2\text{OH} \)

4. From among the isomeric compounds of the molecular formula \( \text{C}_4\text{H}_9\text{Cl} \), choose the one having a \(^1\text{H}\) NMR spectrum that:
   a) Consists of only a single peak
   b) Has several peaks including a doublet at 3.4 ppm
   c) Has several peaks including a triplet at 3.5 ppm
   d) Has several peaks including two distinct three proton signals, one a triplet at 1.0 ppm, and the other a doublet at 1.5 ppm
5. One way to synthesize an alkene, is to heat an alcohol with a catalytic amount of acid. You performed such a reaction last semester in organic lab. When C₆H₁₄O is heated with concentrated H₂SO₄, an alkene is formed with the formula C₆H₁₂. Using the spectral data below, and your knowledge of mechanisms, determine the structures of C₆H₁₄O and C₆H₁₂. Propose a mechanism which backs up your answer.

¹H NMR for C₆H₁₄O: singlet, 0.9 ppm; doublet, 1.2 ppm; broad singlet, 1.6 ppm; quartet, 3.5 ppm

¹H NMR for C₆H₁₂: singlet, 1.7 ppm.
IR for C₆H₁₂