1. Provide all expected products for the following reactions. Label the major products. Explain why the major products are formed. (10 points)

2. Draw the expected transition state for formation of the major product in the second reaction. (10 points)
3. Classify the following pairs of compounds as enantiomers, diastereomers, constitutional isomers or the same compound. (10 points)

![Chemical structures](image1)

4. Provide systematic (IUPAC) names for the following compounds. (5 points)

![Chemical structures](image2)
5. Provide the product(s) for the following chemical reactions. Label them as E1, E2, Sn1 or Sn2. (15 points)

\[ \text{Br} \quad \overset{\text{NaOMe}}{\longrightarrow} \quad \text{MeOH} \]

\[ \text{Me} \quad \overset{\text{NaSH}}{\longrightarrow} \quad \text{DMSO} \]

\[ \text{OH} \quad \overset{85\% \text{ H}_2\text{SO}_4}{\longrightarrow} \quad 170^\circ \text{C} \]

\[ \quad \overset{1. \text{NaNH}_2}{\longrightarrow} \quad 2. \quad \text{Br} \]

6. For the second reaction in #5, draw and label the expected reaction coordinate diagram. Show where the products, reactants, transition state and important energy barriers are located. Consider this reaction an endothermic reaction (\( \Delta H > 0 \)). (10 points)
7. Draw a wedge/dash (staggered) structure for (2R,3S)bromochloropentane. Draw Newman projections for most and least stable conformations. Clearly label these conformers. (10 points)

8. Consider the following reaction, whose rate is governed by the rate law: \( \text{rate} = k[\text{Alkyl Halide}][\text{Nucleophile}] \). A) Give the product and provide an electron pushing mechanism for this reaction. B) What effect on the reaction rate would doubling the nucleophile concentration have? (10 points)
9. Devise a reasonable synthesis for the following molecule. You may only use acetylene (C₂H₂) and any alkylhalide as your sources of carbon. (10 points)

10. Draw all possible isomers for compounds with the molecular formula C₄H₁₁N and calculate the unsaturation number corresponding to this formula. Stereoisomers count! (10 points)