Basics:

- 1) $S_N 2$ reaction
 - a. Draw a generalized mechanism for the $S_N 2$ reaction. Label the nucleophile, the electrophile and the leaving group.
 - b. Draw the reaction energy diagram and label the important minima and maxima.
 - c. Define the rate law for the reaction.
- 2) $S_N 1$ reaction
 - a. Draw a generalized mechanism for the $S_N 2$ reaction. Label the nucleophile, the electrophile and the leaving group.
 - b. Draw the reaction energy diagram and label the important minima and maxima.
 - c. Define the rate law for the reaction.

Problems:

1) Predict the compound in each pair that will undergo the $S_N 2$ reaction faster.



2) Predict the compound in each pair that will undergo solvolysis faster.



3) Show how each compound could be made via an $S_N 2$ reaction.



- 4) Chlorocyclohexane reacts with sodium cyanide in ethanol to give cyanocyclohexane. The rate of formation of cyanocyclohexane increases when a small amount of sodium iodide is added to the solution. Explain.
- 5) List the following carbocations in decreasing order of stability.



- 6) Two of the carbocations above are prone to rearrangement. Suggest how they might rearrange to more stable carbocations.
- 7) Predict the elimination products of the following reactions.
 - a. Sec-butyl bromide and NaOCH₂CH₃
 - b. 3-bromo-3-ethylpentane and methanol
 - c. 2-bromo-3-ethylpentane and NaOCH₃
 - d. 1-bromo-2-methylcyclohexane and NaOCH₂CH₃
- 8) Explain the following observations using appropriate figures.





9) Explain the following E2 reactions. (Hint: draw the chair form)



10) Give mechanisms for the formation of the products of the reactions shown below.



** Problems adapted and copied from Wade's Organic Chemistry 5th ed.

Challenge Problems:

1) The following reaction takes place under second-order conditions, yet it still shows a rearranged product. The rate of this reaction is several thousand times faster than the rate of substitution of 2-chlorobutane under similar conditions. Propose a mechanism to account for the rearrangement observed.



2) Propose mechanisms to account for each product below. (Hint: alkyl shifts can cause ring expansions)

