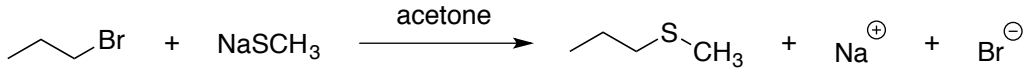
Chemistry 233
Chapter 11 Problem Set – Pt. 1 (Substitution Reactions)

1. Consider the S_N2 reaction shown below and answer the following questions.

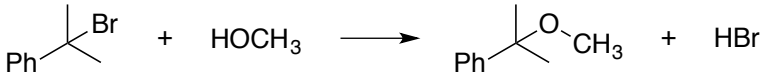


   A. Write the rate law for the reaction.

   B. Identify the nucleophile and the electrophile in the reaction.

   C. State how each of the following factors would affect the rate of the reaction.
      a. Increasing the concentration of 1-bromopropane.
      b. Decreasing the concentration of $NaSCH_3$ by one-half.
      c. Changing 1-bromopropane to 2-bromopropane.
      d. Changing 1-bromopropane to 1-iodopropane.
      e. Changing $NaSCH_3$ to CH_3OH.

2. Consider the S_N1 reaction shown below and answer the following questions.

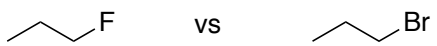


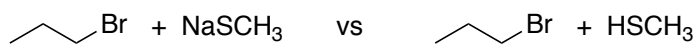
   A. Write the rate law for the reaction.

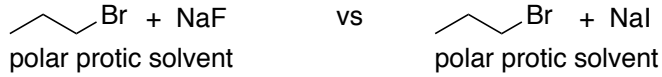
   B. Identify the nucleophile, the electrophile, and the reaction solvent.

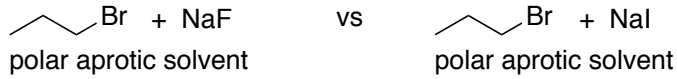
   C. State how each of the following factors would affect the rate of the reaction.
      a. Increasing the concentration of the alkyl halide.
      b. Increasing the concentration of $HOCH_3$.
      c. Replacing $HOCH_3$ with $NaOCH_3$.
      d. Changing the alkyl halide from a bromide to an iodide.
      e. Changing the alkyl halide to 1-bromopropane.

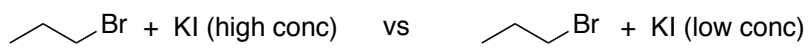
3. For each of the following pairs, circle the one that will proceed faster by an S_N2 reaction mechanism.



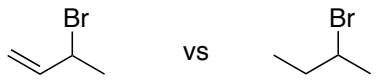


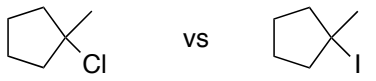


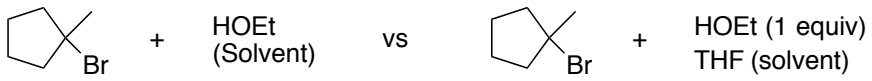


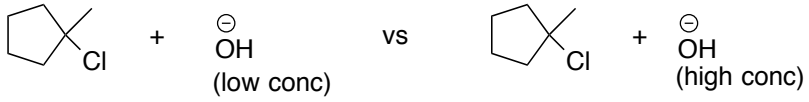


4. For each of the following pairs, circle the one that will proceed faster by an S_N1 reaction mechanism.

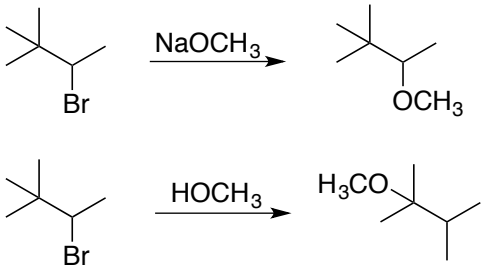




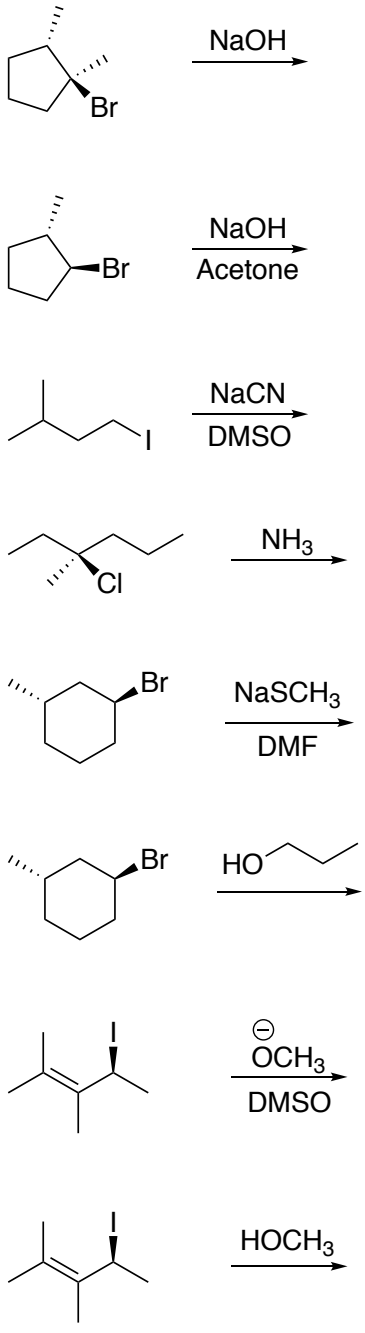


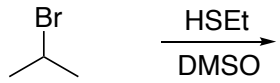


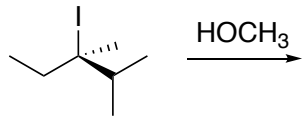
5. Explain why the two reactions below provide constitutionally different products.

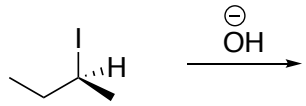


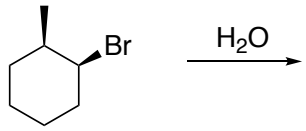
6. Assuming each reaction below undergoes nucleophilic substation, predict the mechanism (S_N1 or S_N2) and draw the major product. Include stereochemistry where appropriate.

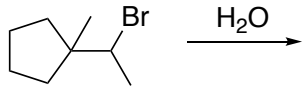


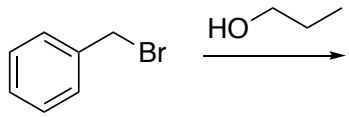


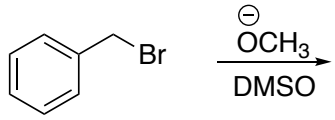


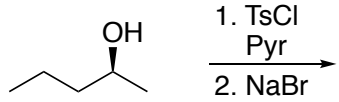


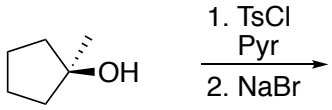


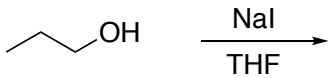




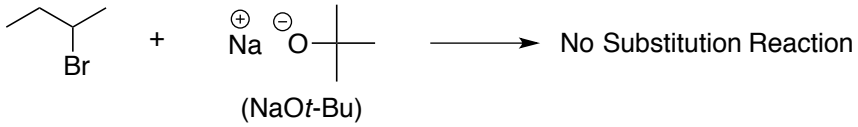




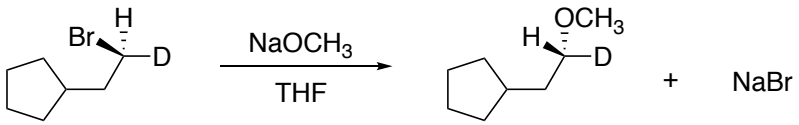




7. Explain why the reaction below does not provide any products from nucleophilic substation.



8. Show the complete electron pushing mechanism for each of the following reactions. *You do not need to show stereochemistry in the mechanism.*



D is just a heavy isotop of H.