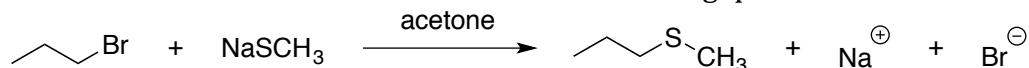


Answer Key

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.

↑ rate

b. Decreasing the concentration of NaSCH₃ by one-half.

↓ rate by 1/2

c. Changing 1-bromopropane to 2-bromopropane.

↓ rate

d. Changing 1-bromopropane to 1-iodopropane.

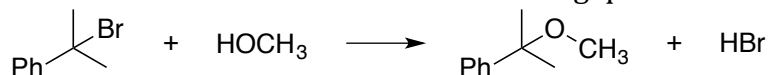
↑ rate

e. Changing NaSCH₃ to CH₃OH.

↓ rate Changing a strong Nu to a weak Nu

↑ better L.G.
 ← more substituted = slower S_N2

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.

↑ rate

b. Increasing the concentration of HOCH₃.

No change

c. Replacing HOCH₃ with NaOCH₃.

No change

d. Changing the alkyl halide from a bromide to an iodide.

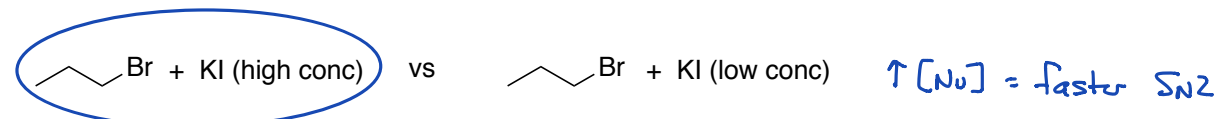
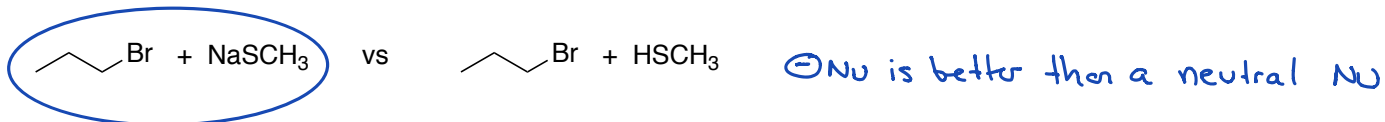
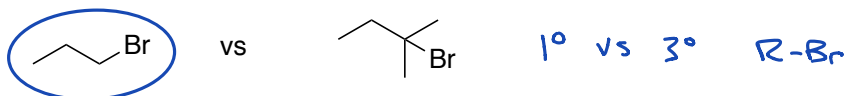
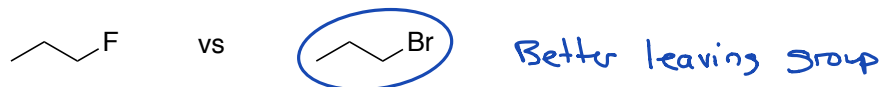
↑ rate

e. Changing the alkyl halide to 1-bromopropane.

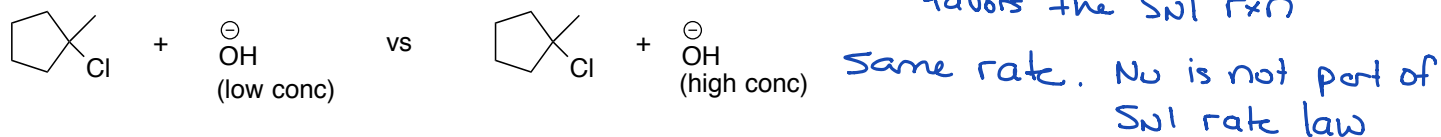
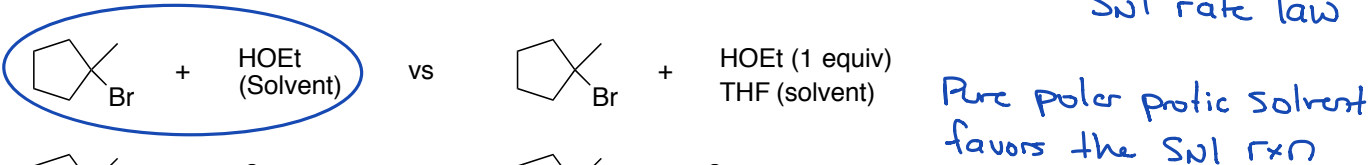
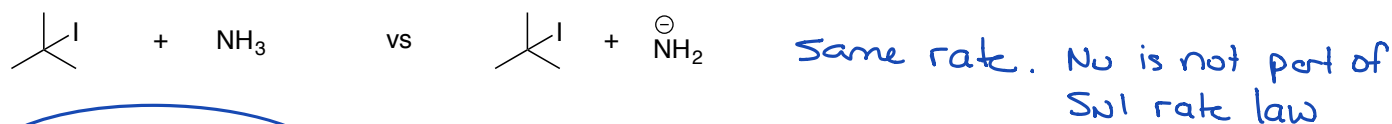
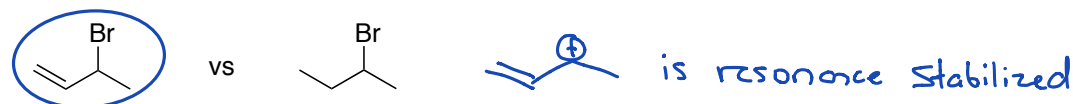
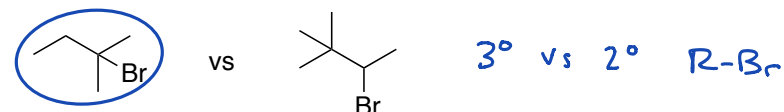
↓ rate (no S_N1 rxn would occur)

↑ Better L.G.

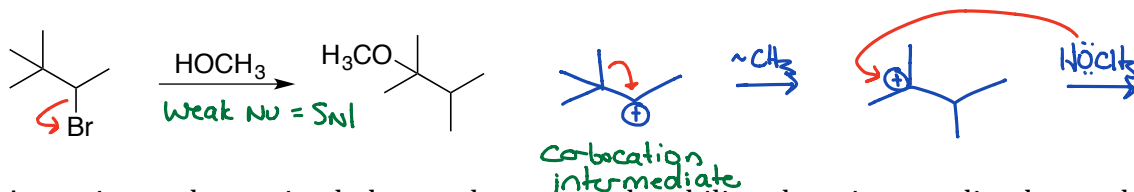
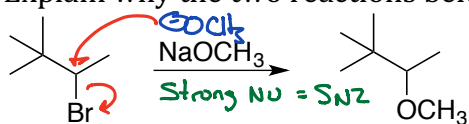
3. For each of the following pairs, circle the one that will proceed faster by an S_N2 reaction mechanism.



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

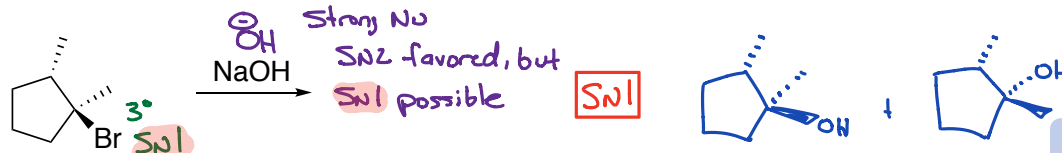


5. Explain why the two reactions below provide constitutionally different products.

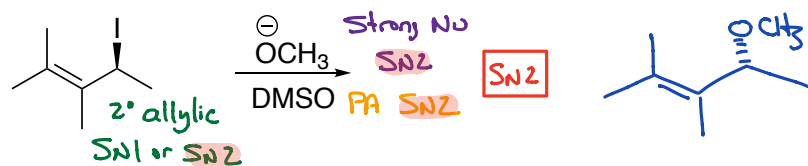
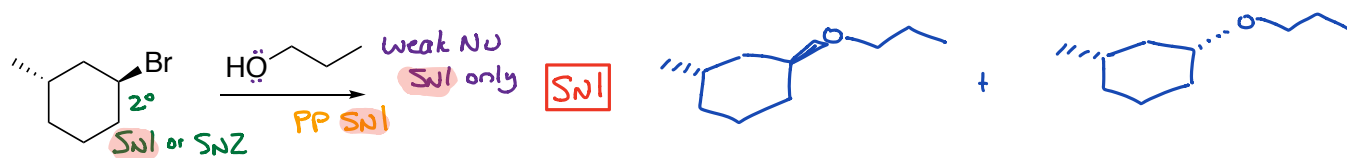
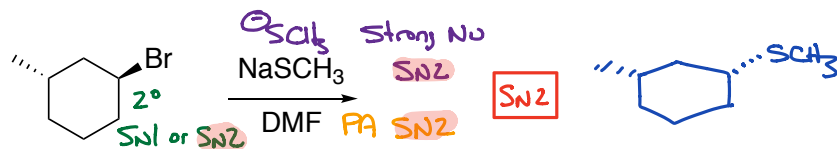
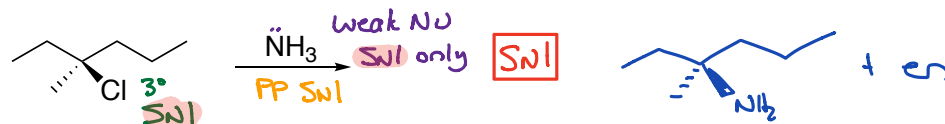
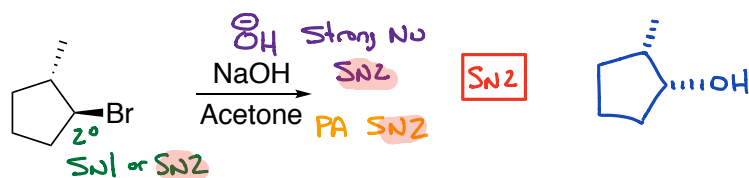


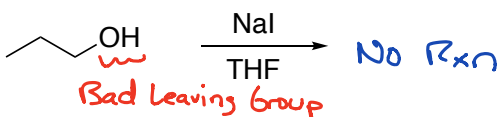
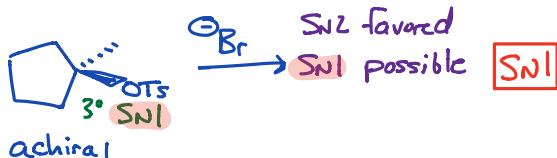
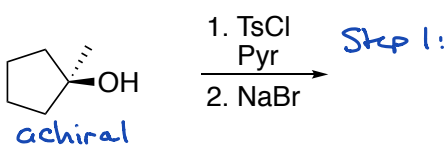
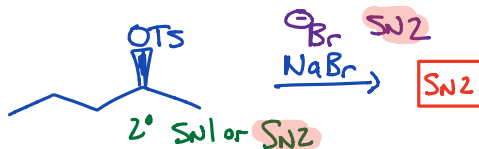
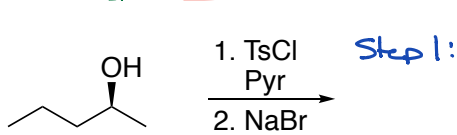
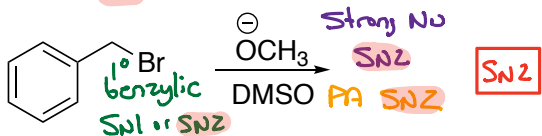
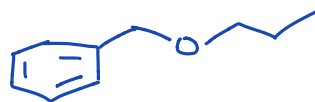
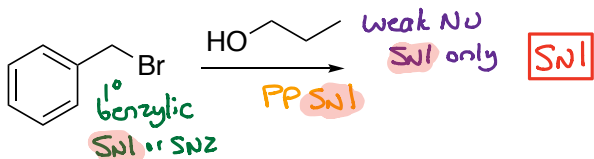
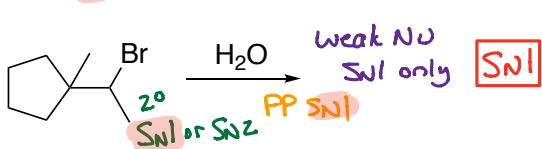
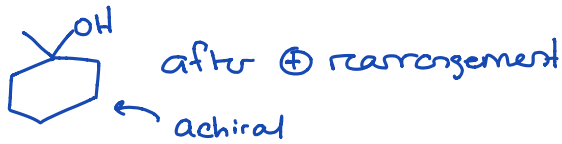
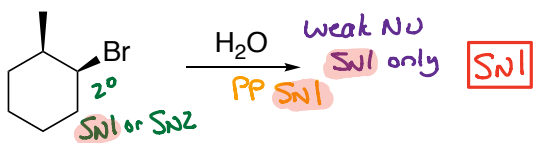
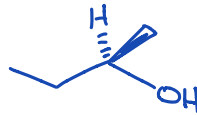
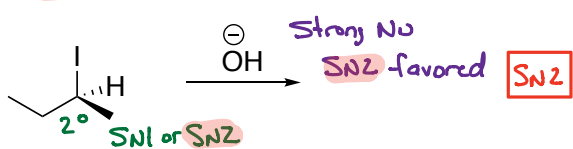
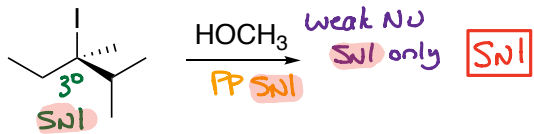
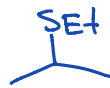
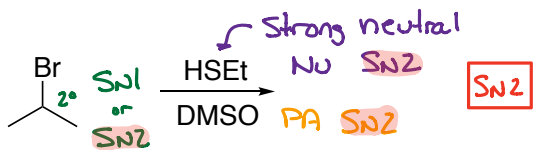
6. Assuming each reaction below undergoes nucleophilic substitution, predict the mechanism (S_N1 or S_N2) and draw the major product. Include stereochemistry where appropriate.

PP = polar protic
PA = polar aprotic

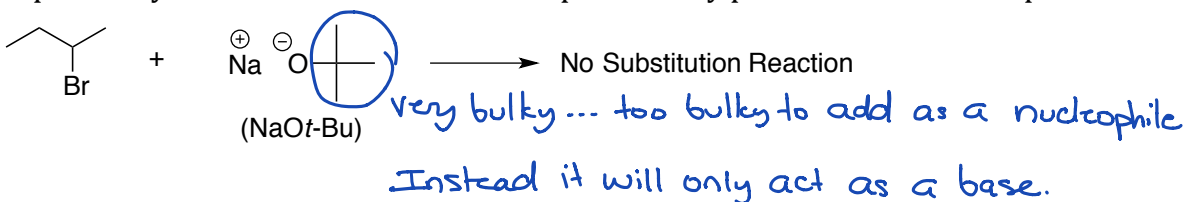


S_N1: When Nu attacks ⊕ it will attack from the front and back which can result in stereoisomers

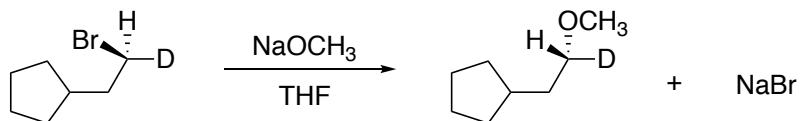




7. Explain why the reaction below does not provide any products from nucleophilic substitution.



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 isotope of H.

