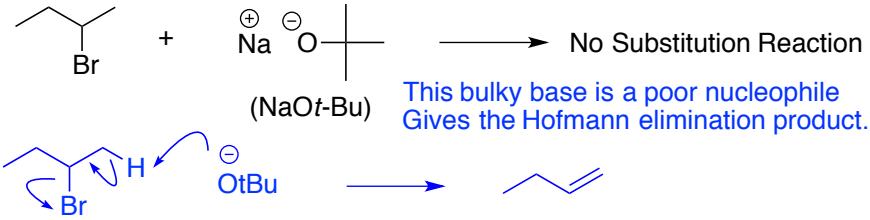
Chemistry 233
Chapter 11 Problem Set – Pt. 2 (Elimination Reactions) Answer Key

1. The example below was given on the Ch. 9 Problem Set. Given what you now know, what product(s) would you expect to isolate from this reaction?

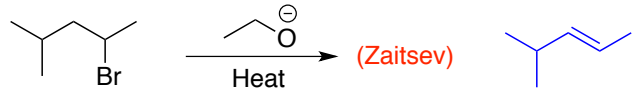


2. Specify how each of the following would affect the rate of an **E2** reaction. E2 rate = k[RX][Base]
   a. Increase changing the base from $NaOCH_3$ to $NaNH_2$.
      Increased rate (H_2N^- is a stronger base than H_3CO^-)
   b. Increasing the concentration of base.
      Increased rate
   c. Decreasing the concentration of alkyl halide.
      Decreased rate
   d. Changing the alky halide from 2-bromo-2-ethylpentane to 2-bromopentane.
      Decreased rate (in E2, 3° halide is more reactive than 2° halide)
   e. Changing the alkyl halide from 2-bromopentane to 2-iodopentane.
      Increased rate (I^- is a better leaving group than Br^-)

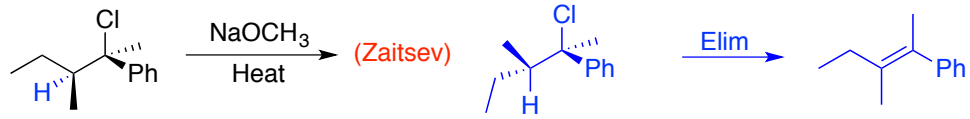
3. Specify how each of the following would affect the rate of an **E1** reaction. E1 rate = k[RX]
   a. Changing the base from NaOH to H_2O.
      No change (in E1 the base has no effect on the rate)
   b. Decreasing the concentration of base.
      No change (in E1 the base has no effect on the rate)
   c. Changing the solvent from acetone to methanol.
      Increased rate (E1 reactions go faster in a polar protic solvent that stabilizes the LG and carbocation.
   d. Changing the alky halide from 2-bromo-2-ethylpentane to 2-bromopentane.
      Decreased rate (in E1, 3° halide is more reactive than 2° halide)

4. Predict the product(s) for each of the E2 elimination reactions below. Identify the major product for each.

a.

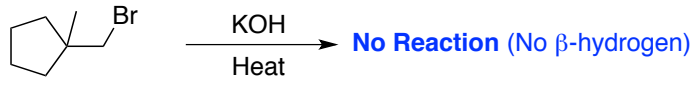


b.



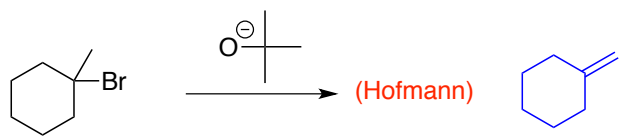
orient H & Cl antiperiplanar

c.

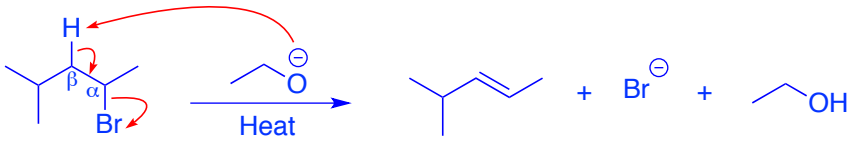


No Reaction (No β-hydrogen)

d.

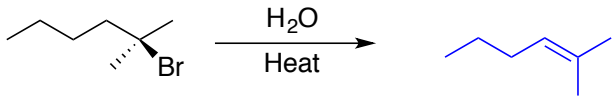


5. Show the complete electron pushing mechanism for the reaction in **question 4 part a**.

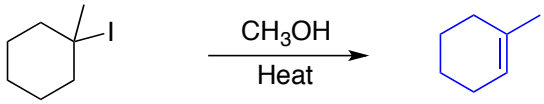


6. Predict the product(s) for each of the E1 elimination reactions below. Identify the major product for each.

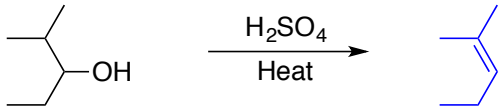
a.



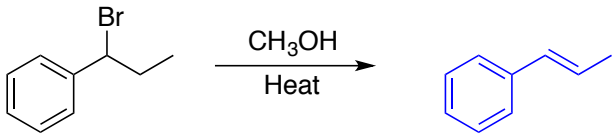
b.



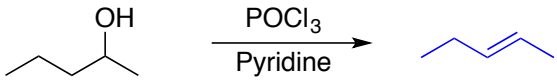
c.



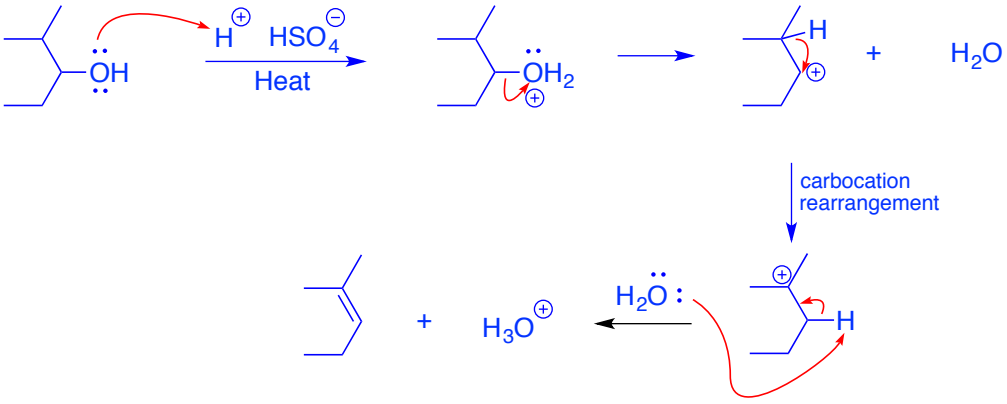
d.



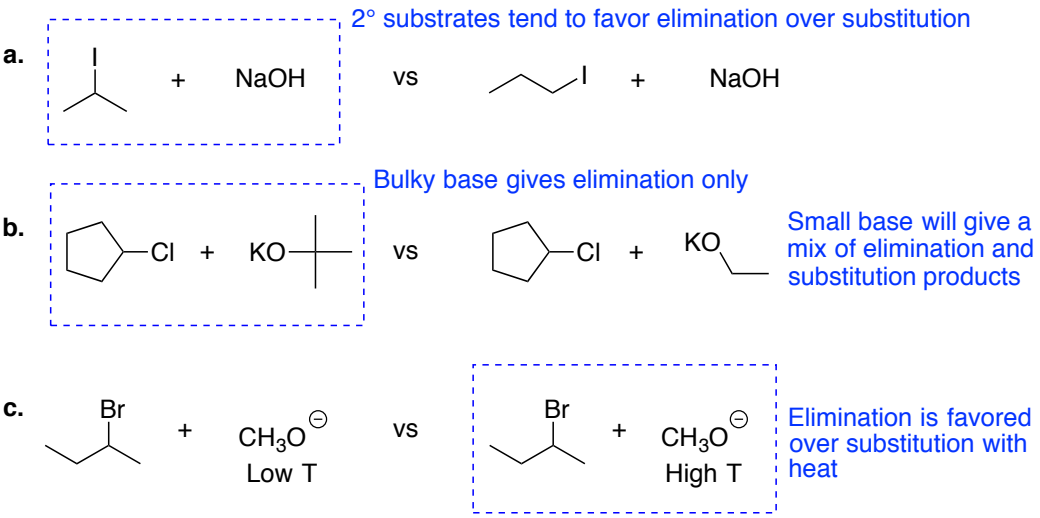
e.



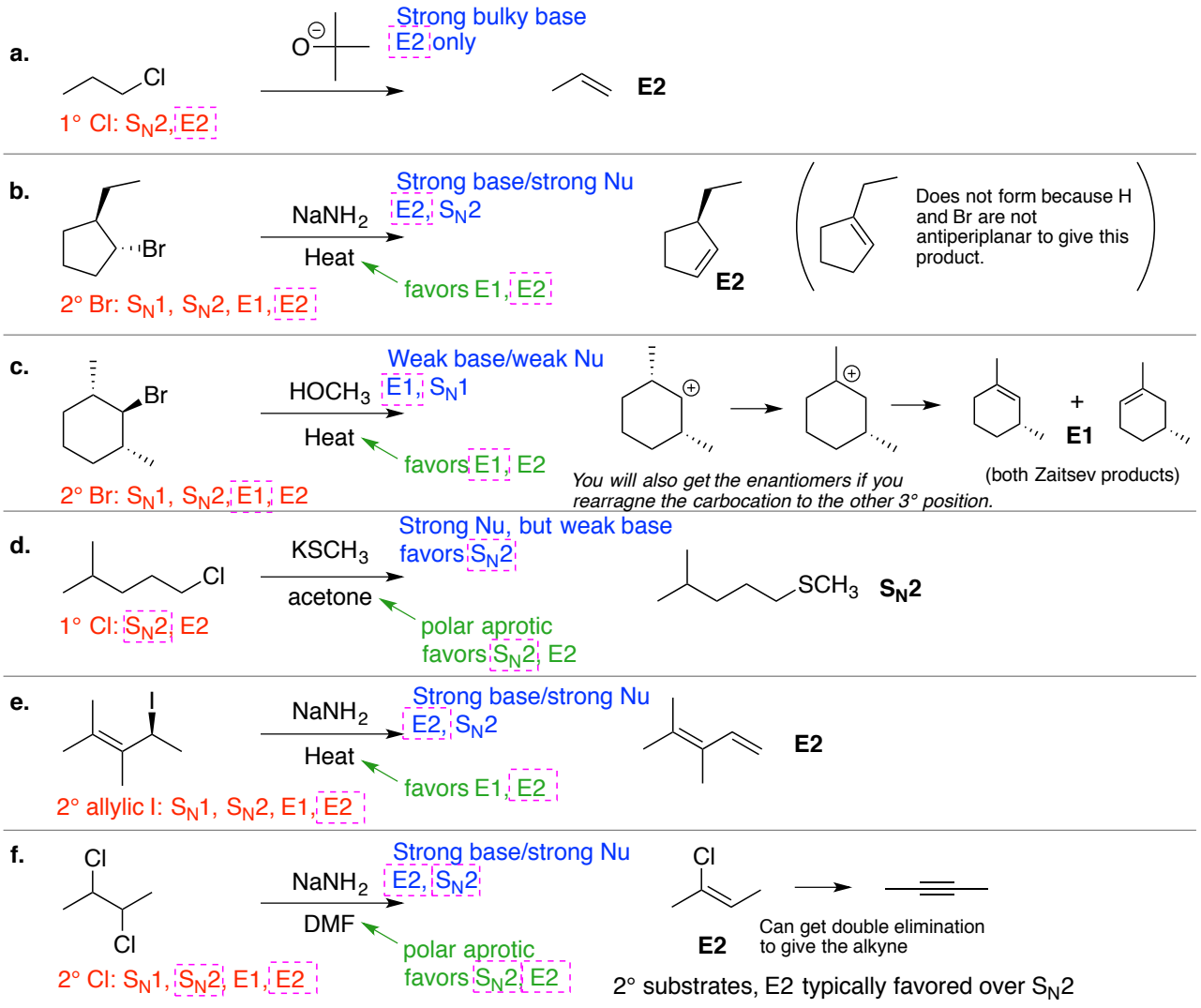
7. Show the complete electron pushing mechanism for the reaction in **question 6 part c**.
Here you are simply protonating the alcohol to make it a good leaving group, then using water or HSO_4^- as a base to do the elimination step.

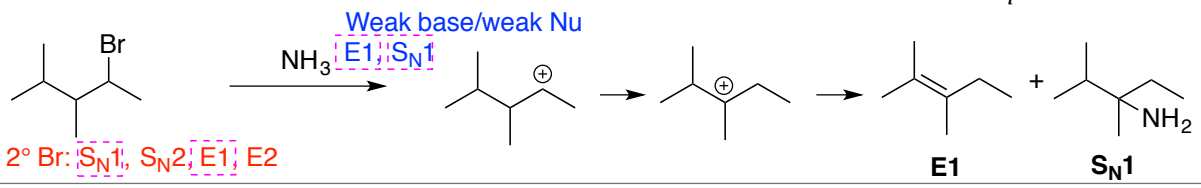


8. Circle the one in each of the following pairs that would be expected to give a higher yield of elimination over substitution.

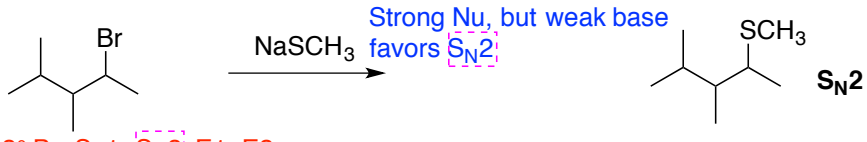


9. For each of the following reactions, predict the major mechanism (S_N1, S_N2, E1, or E2) and provide the major product. Show correct stereochemistry where appropriate.



g. 

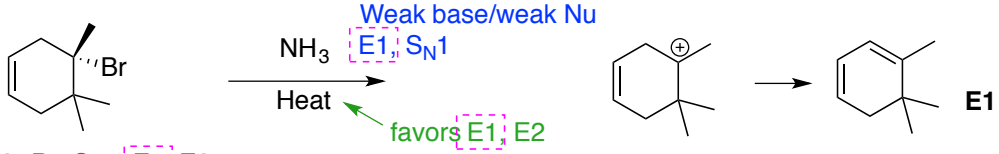
2° Br: S_N1, S_N2, E1, E2

h. 

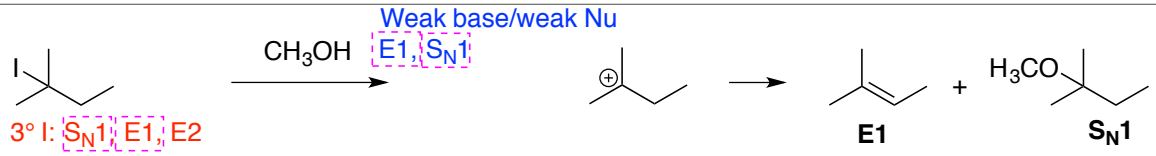
2° Br: S_N1, S_N2, E1, E2

i. 

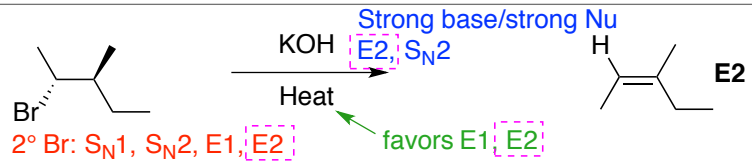
2° I: S_N1, S_N2, E1, E2

j. 

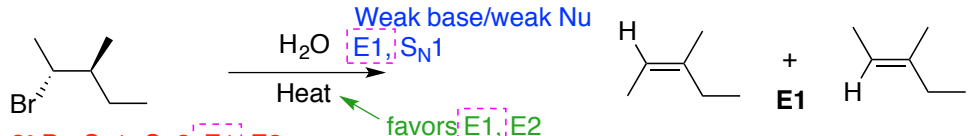
3° Br: S_N1, E1, E2

k. 

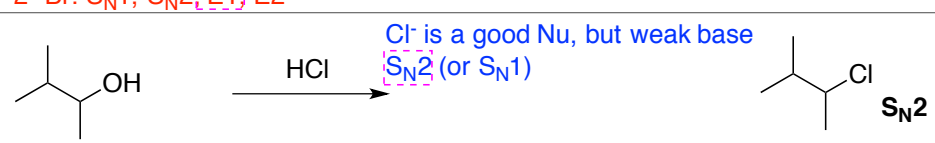
3° I: S_N1, E1, E2

l. 

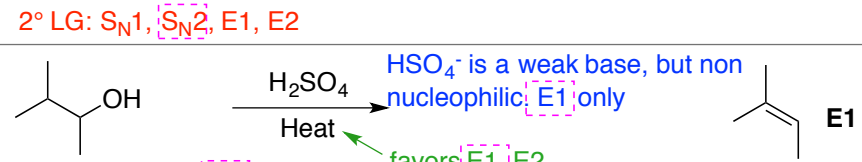
2° Br: S_N1, S_N2, E1, E2

m. 

2° Br: S_N1, S_N2, E1, E2

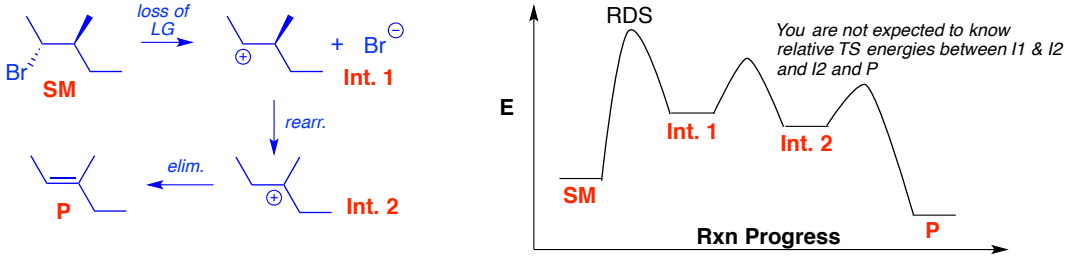
n. 

2° LG: S_N1, S_N2, E1, E2

o. 

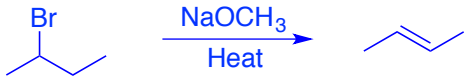
2° LG: S_N1, S_N2, E1, E2

10. Draw an energy diagram for reaction **m** in question 9.

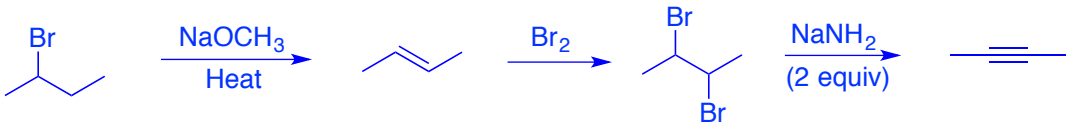


11. **Synthesis:** Propose a synthesis for each of the following starting with 2-bromobutane.

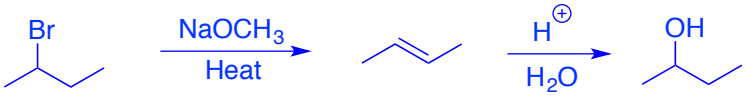
a. 2-butene



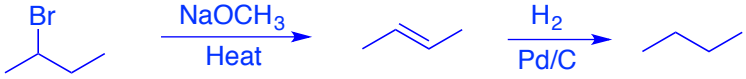
b. 2-butyne



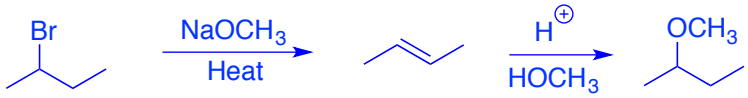
c. 2-butanol



d. butane



e. 2-methoxybutane



Could also treat 2-bromopropane directly with $NaOCH_3$ to give the substitution product, however it would likely be minor wile the elimination product would be the major product.

12. Show three reactions that can be used to eliminate 2-butanol to give 2-butene. Show two reactions that can be used to eliminate 2-butanol to give 1-butene.