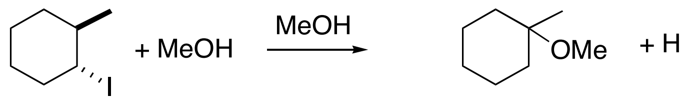
Problem set 6

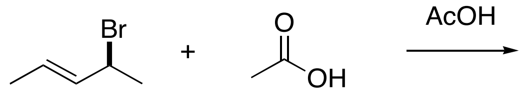
Name____________________
SID____________________

1) (8 pts) Using curved arrow notation, provide a mechanism that accounts for the following transformation.



(2 pts) Is this an S_N1 or an S_N2 reaction mechanism?

2) Consider the following reaction conditions (note that the starting bromide is optically active):



a) (2 pts) What is the nature (1˚, 2˚, etc.) of the electrophile (*i.e.* alkyl halide)?

Does this favor an S_N1 or an S_N2 mechanism?

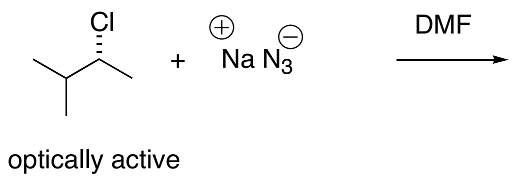
b) (2 pts) Consider the nucleophile. Does it favor an S_N1 or an S_N2 mechanism?

c) (2 pts) Consider the solvent. Does it favor an S_N1 or an S_N2 mechanism?

d) (2 pts) Consider the leaving group. Does it favor an S_N1 or an S_N2 mechanism?

e) (2 pts) Draw the product you predict for the product, based on the above analysis. Is the product optically active or racemic?

3) Consider the following reaction conditions:



a) (2 pts) What is the nature (1˚, 2˚, etc.) of the electrophile (*i.e.* alkyl halide)?

Does this favor an S_N1 or an S_N2 mechanism?

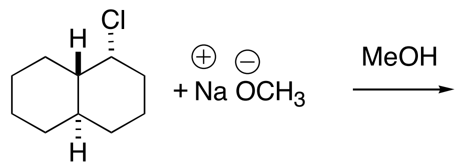
b) (2 pts) Consider the nucleophile. Does it favor an S_N1 or an S_N2 mechanism?

c) (2 pts) Consider the solvent. Does it favor an S_N1 or an S_N2 mechanism?

d) (2 pts) Consider the leaving group. Does it favor an S_N1 or an S_N2 mechanism?

e) (2 pts) Draw the product you predict for the product, based on the above analysis. Is the product optically active or racemic?

4) Consider the following reaction conditions:

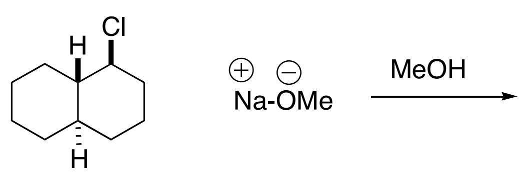


a) (2 pts) Does the structure of the electrophile favor a unimolecular reaction (E1, S_N1) or a bimolecular (E2 or S_N2) reaction?

b) (2 pts) Does the nucleophile/base favor substitution or elimination?

c) (2pts) draw the major organic product you predict based upon the analysis above.

5) Consider the following reaction conditions:

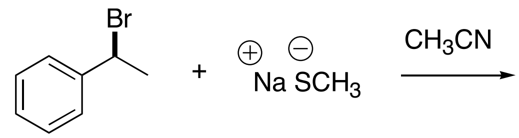


a) (2 pts) Why must the mechanism for this reaction be different than in question 4, even though the nucleophile/base and solvent are the same?

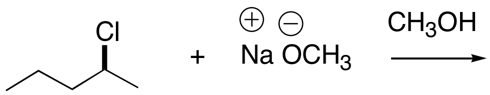
b) (2 pts) What is the major organic product from this reaction?

6) (5 pts each) Predict the major organic product that each of the following reaction will provide. Where stereochemistry is an issue, make sure you address whether or not the products will be optically active or racemic. Also make sure the geometry of your double bonds is correct.

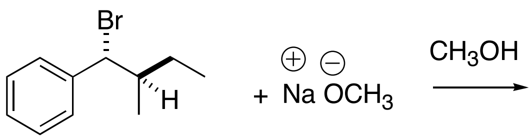
A)



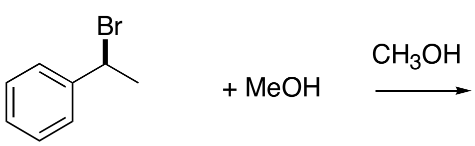
B)



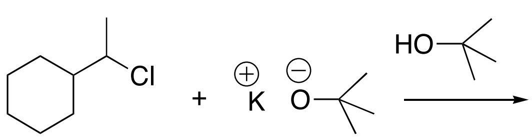
C)



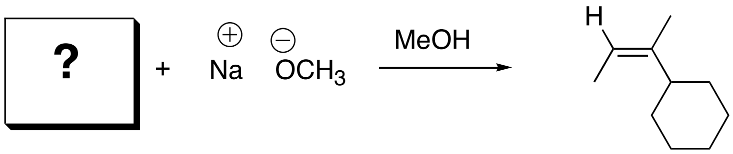
D)

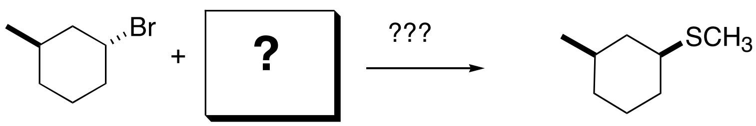


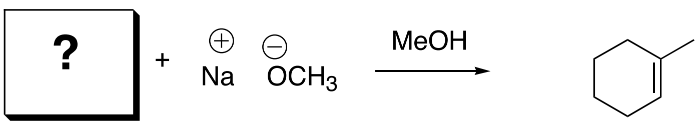
E)

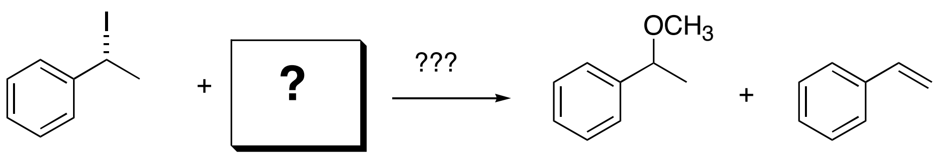


7) (5 pts each) Fill in the missing reagents or starting material for the following reaction. Pay special attention to stereochemistry and the geometry of double bonds.

A) 

B) 

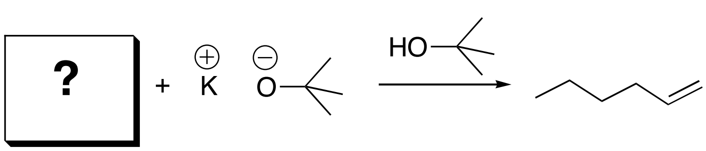
C) 

D) 

optically active

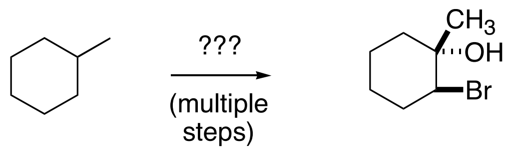
Major (racemic)

Minor

E) 

10) (10 pts) One of the goals of this class is to have an appreciation for how molecules are made. In practice, organic chemists are given a molecule and asked to find a way to make it. So lets start thinking about how we do this.

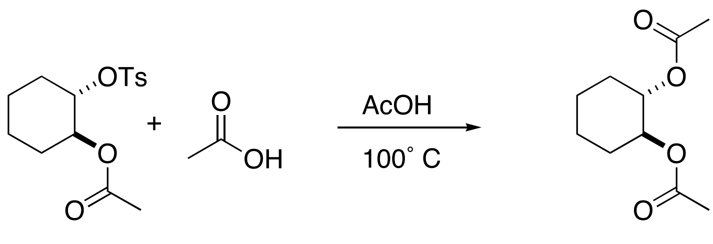
Starting from methylcyclohexane (**1**), how would you make compound **2**? You may use any inorganic reagents (reagents that do not have carbon and hydrogen) and any organic reagent containing two or fewer carbons.



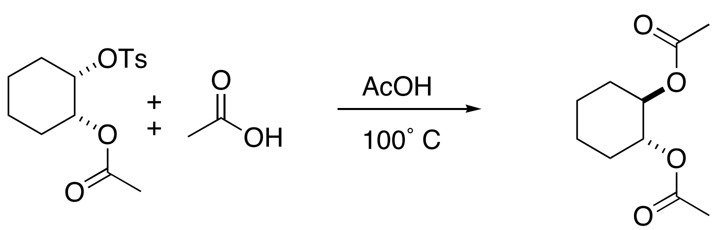
1 **2**

This one might take a while to figure out. You need to think backwards, and you're probably not used to thinking this way. Think about what functional groups are present and then think of ways you know how to make that arrangement of functional groups (i.e. how do you make a trans bromohydrin?). This will tell you what the starting material should be for that reaction. Repeat this process until you get to the given starting material. The chapter summaries will be very useful for this exercise.

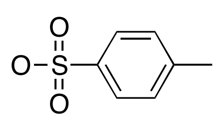
Extra Credit (10 pts): Compounds **3** and **5** are the same except that one has a trans relationship between the tosylate (OTs, a very good leaving group) and the acetate groups, and the other has a cis relationship between these groups. Under conditions involving acetic acid as both nucleophile and solvent, both reactions are found to be stereospecific to give the trans di-acetate product. Compound **3**, however, reacts nearly 700 times faster than compound **5**. Propose mechanisms that account for both the stereospecificity and the rate difference. (Hint, the C=O is drawn in a way that makes this hard to see...but remember that you can rotate around the C-O single bonds.)



3 **4**



5 **6**

OTs = 

, a very good leaving group derived from sulfuric acid.