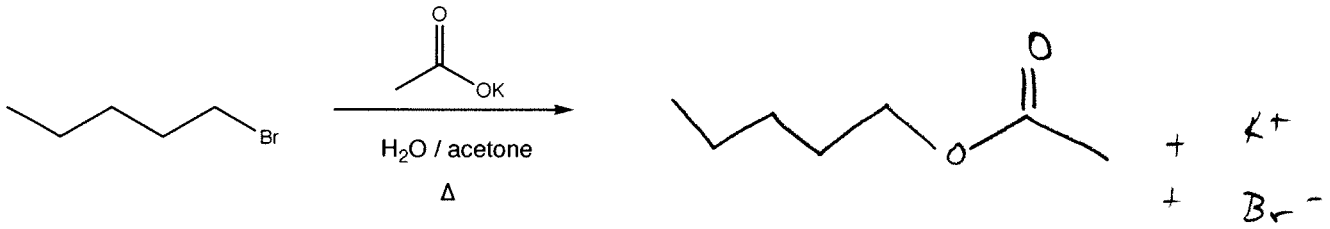
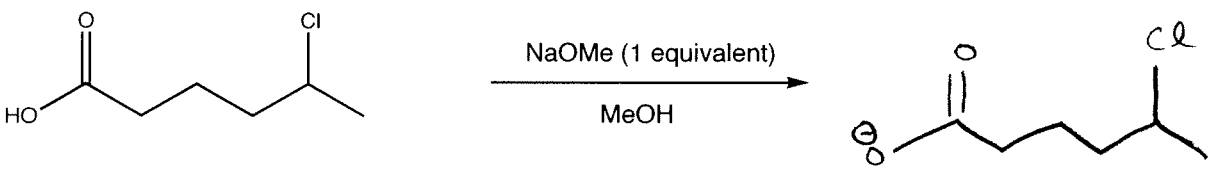
1. (30 points) **Predict the product(s), including stereochemistry** for the following reactions that do take place.
   - When more than one organic product is formed, indicate the relative amounts of those products and their stereochemical relationships.
   - In each case, you need only consider the products of the dominant mechanism and the only reaction mechanisms you need to consider as possibilities are S_N1, S_N2 and ACID-BASE.
   - If no reaction is likely, indicate **no reaction** and ***provide a brief explanation why.***

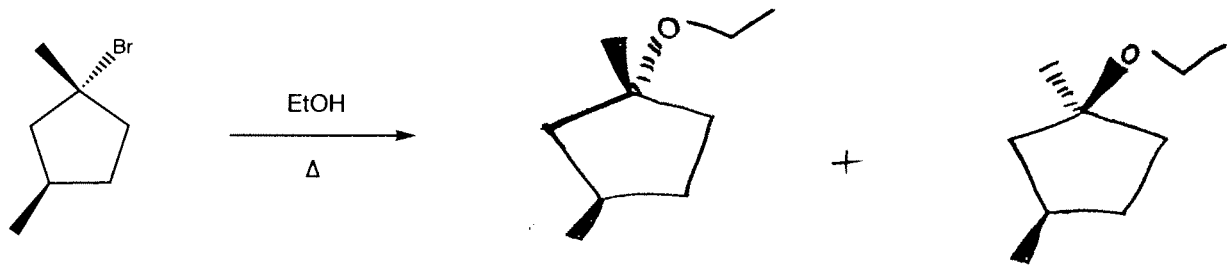
A)



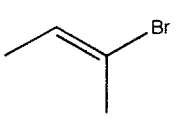
B)



C)



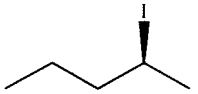
~ 50/50 mixture of diastereomers

D) 

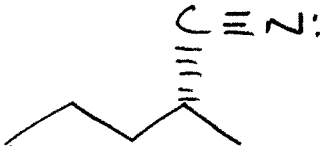
NaCN
DMSO
Δ

No Reaction

sp^2 hybridized C is unlikely to react by S_N1 or S_N2.

E) 

NaCN
DMSO
Δ



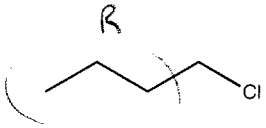
+ Na^+ I^-

2. (12 points) Consider the reaction below.

A) Predict the products for the following reaction

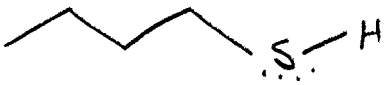
B) Show the detailed arrow-pushing mechanism.

C) ***Sketch the transition state for the slow step of the reaction mechanism.*** Pay close attention to the relative positions of various groups in space in the transition state. You may use an appropriate abbreviation (-R) for the long chain in the sketch.

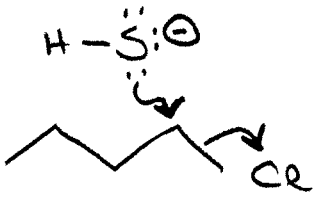


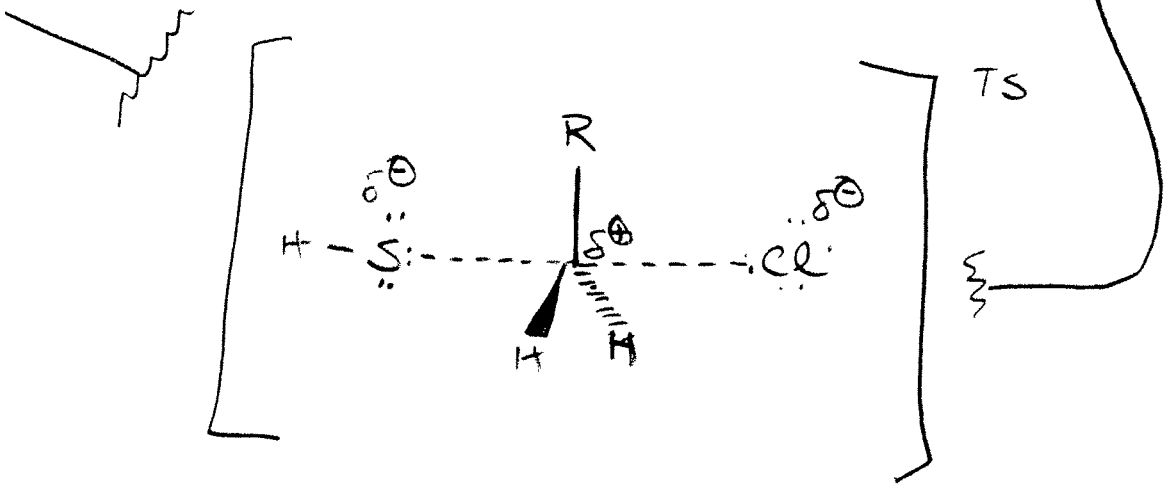
+ Na^+ HS^-

Δ
water / acetone



+ Na^+
+ Cl^-

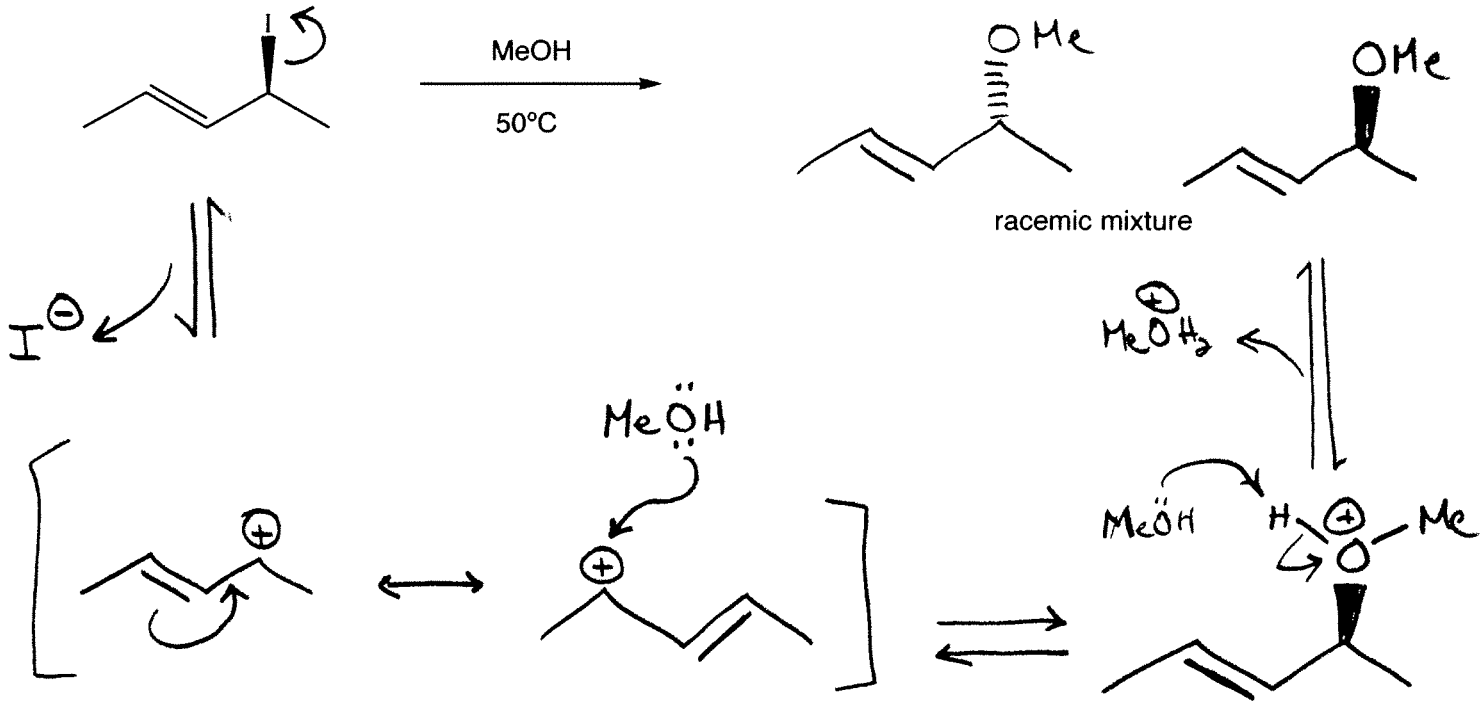




3. (12 points) Consider the reaction below.

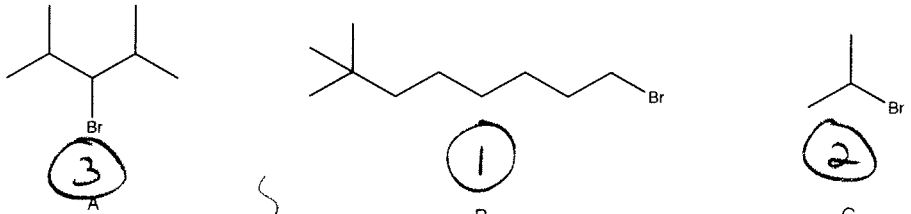
A) Predict the products for the following reaction. A racemic mixture is expected.

B) Show a complete arrow-pushing mechanism for the formation of **one** of the enantiomeric products of the reaction. Include resonance structures of any intermediates that are resonance stabilized.



(note: resonance structures are identical in this case; preventing additional isomeric products)

4. (7 points) Put the following three compounds in order of their rates of reaction by an S_N2 mechanism. *Briefly* explain the ordering.

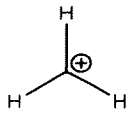


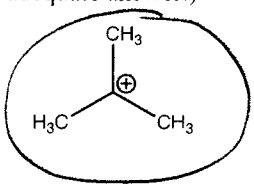
B > C > A

Most steric interference

Least hindered α-C

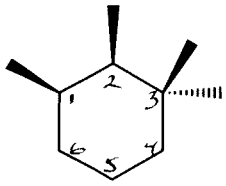
5. (7 points) Which of the two following carbocations is the ***more stable***. Briefly and ***specifically*** explain. (Indicating the level of substitution only is not an adequate answer.)

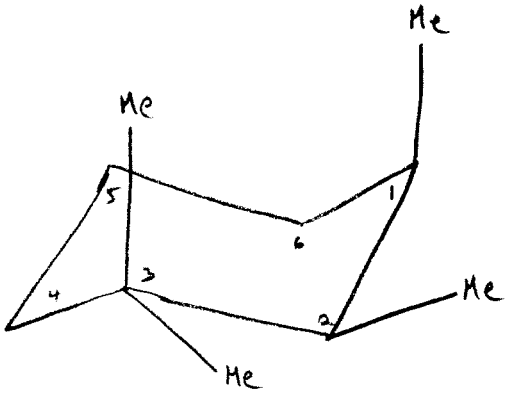




hyperconjugation stabilizes the C+

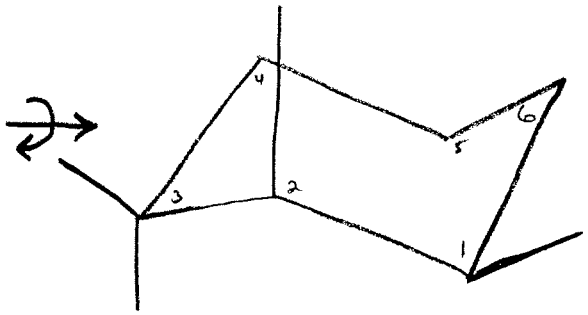
6. (10 points) Provide both chair conformers for the following compound and indicate their relative stabilities. Provide a *brief* explanation for that assignment.





2 axial - same Me sides

LESS STABLE



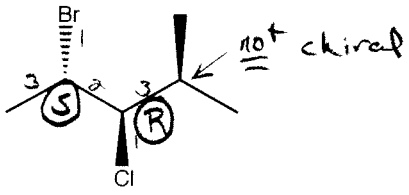
2 axial - opposite sides Me

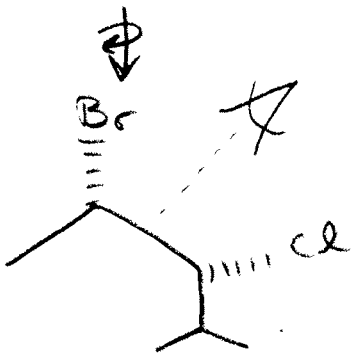
MORE STABLE

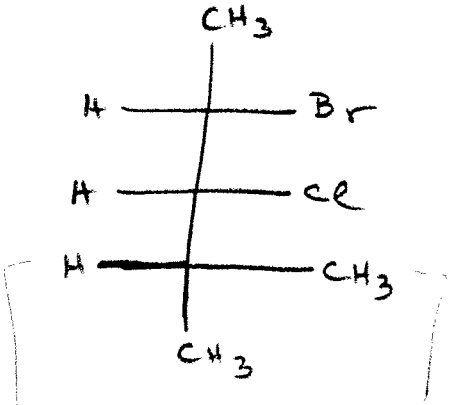
7. (10 points) Consider the molecule below.

A) Label each **stereocenter** as R or S.

B) Depict the molecule as a Fischer projection.





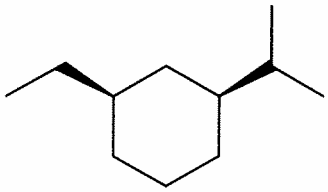


relative position for Me's in isopropyl group not important

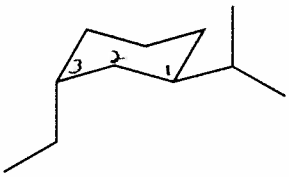
8. (20 points) Indicate the relationship of the each of the following pairs of structures.

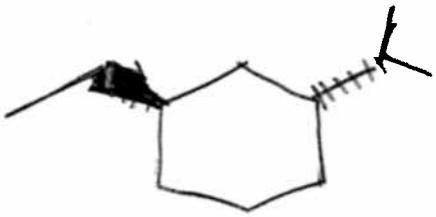
They could be any of the following possibilities: Same compound (SAME), Enantiomers (EN), Diastereomers (DIA), Structural Isomers (SI) or Not Isomers *different molecular formulas* (NI).

A)

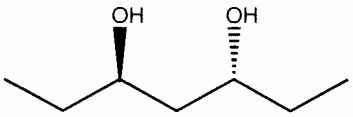


DIA

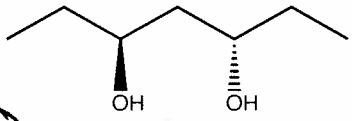




B)



EN



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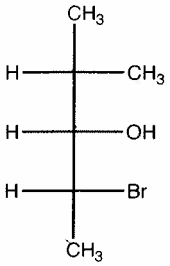
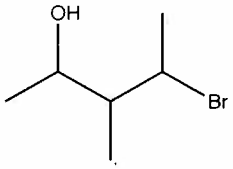
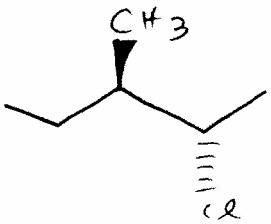
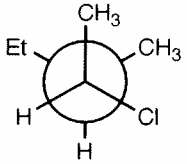


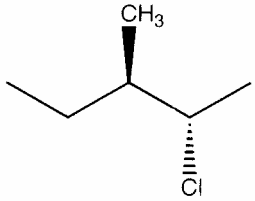


SI

D)







SAME