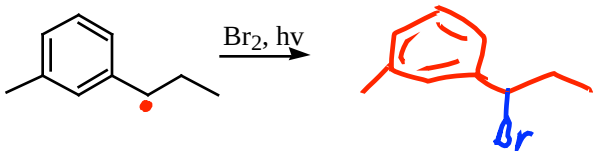
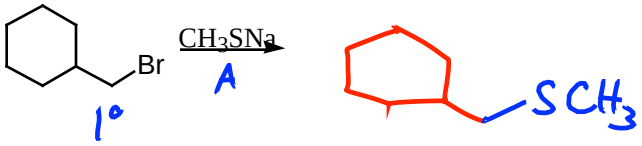
JASPERSE CHEM 350 TEST 2 VERSION 1

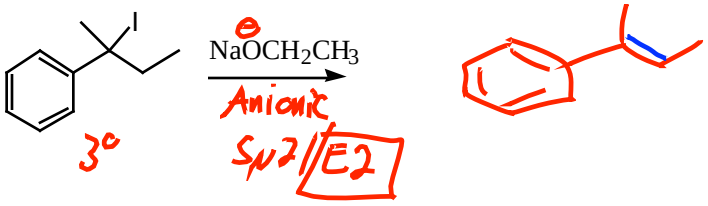
Ch. 4 The Study of Chemical Reactions; Ch. 5 Stereochemistry

Ch. 6 Alkyl Halides: Nucleophilic Substitution and Elimination

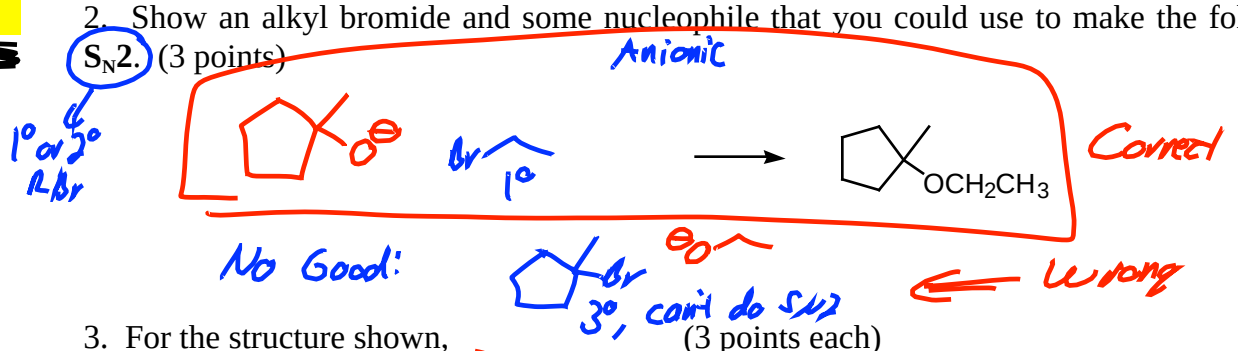
1. Predict the major organic product for each of the following. (3 points each)





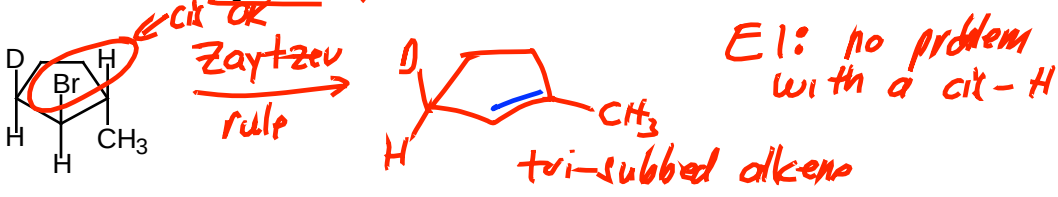


2. Show an alkyl bromide and some nucleophile that you could use to make the following by S_N2. (3 points)

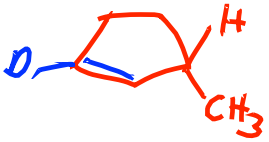


3. For the structure shown, (3 points each)

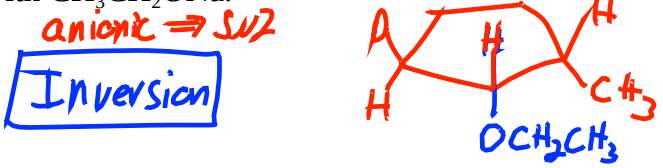
a. Draw the major elimination product formed upon treatment with H_2O/heat.



b. Draw the major elimination product formed upon treatment with CH_3CH_2ONa.



c. Draw the major substitution product formed upon treatment with CH_3CH_2ONa.



(3 points for each multiple choice question)

4. Which of the following is true regarding an S_N1 reaction?
   a. It would be faster at 25˚ than 50˚ F
   b. It would be faster in ethanol than in pentane T
   c. Keeping the moles of reactants constant but doubling the quantity of solvent would decrease the rate by a factor of 4. F $r = k[R][X]$
   d. Stereochemical inversion occurs exclusively F

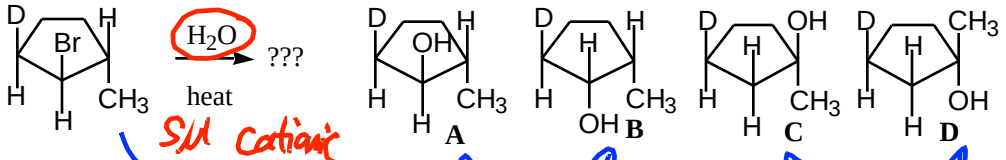
SN2 true
SN1 true

6. Which of the following statements is true?
   a. The rate determining step is always the last step in a reaction mechanism. F
   b. The stability/reactivity principle says that the more stable of two chemicals will be more reactive F
   c. The reactivity/selectivity principle says that the more reactive of two chemicals will be less selective. T Cl• vs. Br•
   d. The activation barrier for a reaction is the difference in energy between reactants and final products. F

7. Which of the following statements is true about the chlorination of methane?
   a. In each propagation step a radical is produced T
   b. 6.02×10^{23} initiation events are needed to make one mole of chloromethane F
   c. Most chloromethane is made by combination of a methyl radical with a chlorine radical F
   d. The overall chlorination of methane is strongly endothermic. F

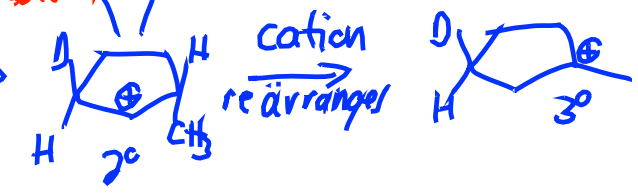
8. Which of the following statements is FALSE?
   a. Optically active solutions ~~solutions~~ always contain chiral molecules. T
   b. Two diastereomers always have identical melting points F enant yes, diast no
   c. Optically inactive solutions are either racemic or else contain no chiral chemicals at all T
   d. A solution with 60% optical purity would have an 80/20 mix of enantiomers T

9. When the reactants shown undergo substitution, which of the products A-D will form? (3 points)



SN1 Cation

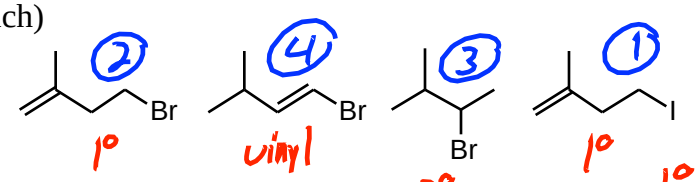
a. ~~A only~~
b. B only
c. A and B → expect for normal SN1. Racemic
d. A, B, and C
e. A, B, C, and D



Result of cation rearrangement

10. Rank the reactivity of the structures shown toward the reactant(s) indicated on the left (1 being most, etc.) (3 points each)

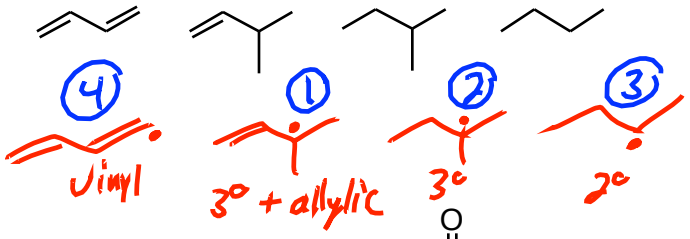
$NaOCH_2CH_3$ anionic SN2/E2



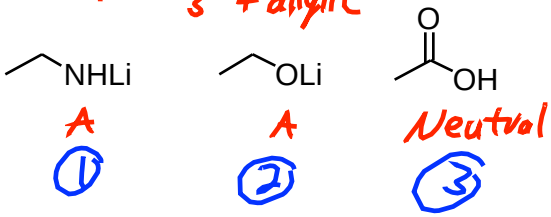
1° > 2° > 3°
I > Br > Cl

Br_2/hv

R-H → R•



CH_3Br SN2 nucleophiles

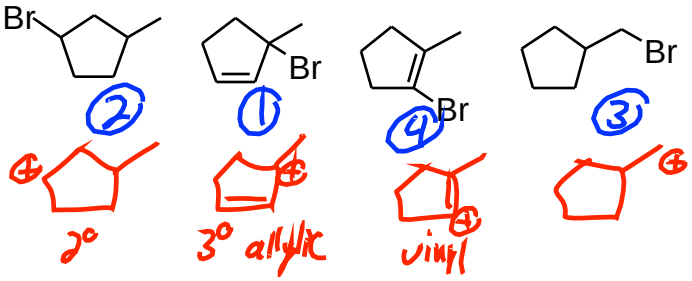


energy → stability

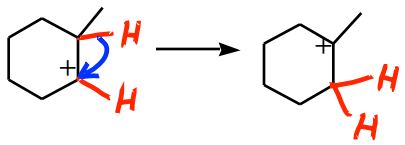
H_2O, heat, catalytic H^+

SN1

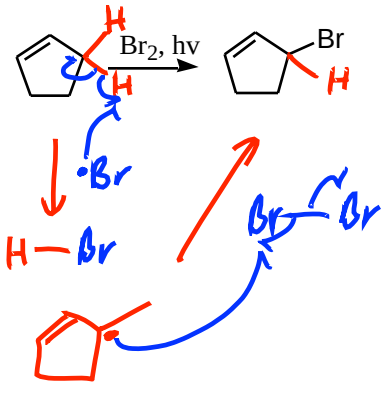
RX → R⊕



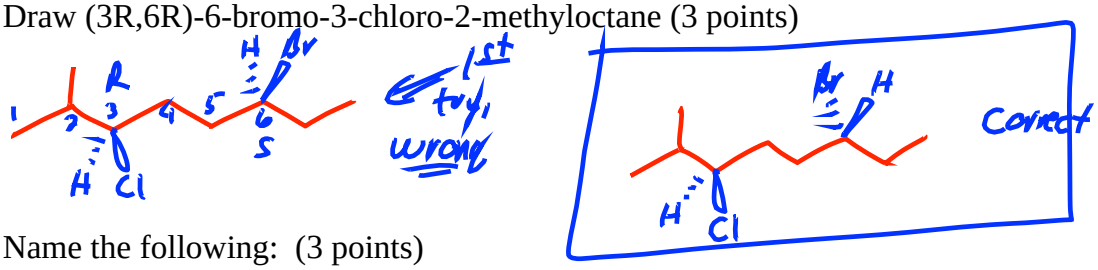
11. Carbocations often rearrange, as shown below. Draw in the hydrogens on the two carbons involved in the rearrangement, and show formal arrow-pushing to illustrate the transformation. (3 points)



12. Draw the mechanism for the following reaction, propagation steps only. (4 points)

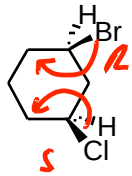


13. Draw (3R,6R)-6-bromo-3-chloro-2-methyloctane (3 points)



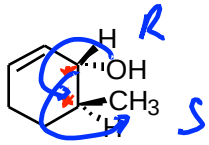
14. Name the following: (3 points)

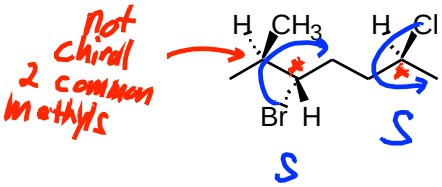
(optically active)



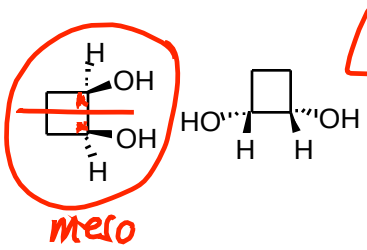
(1R,3S)-
1-bromo-3-chlorocyclohexane

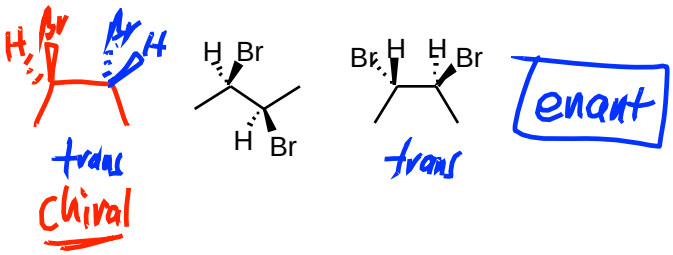
15. Classify each of the chiral carbons in the following structures as R or S (there may be more than one in a molecule). (10 points)

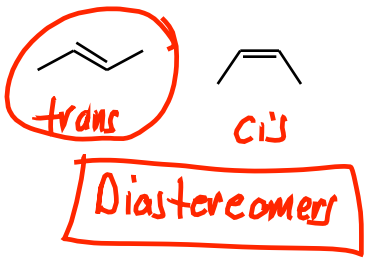


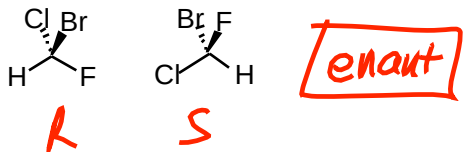


16. a. Classify each pair as diastereomers, enantiomers, or same. (12 points)
b. For the first structure of each pair, circle it if it is **not** chiral
c. For the first structure of each pair, write "meso" by it if it is meso

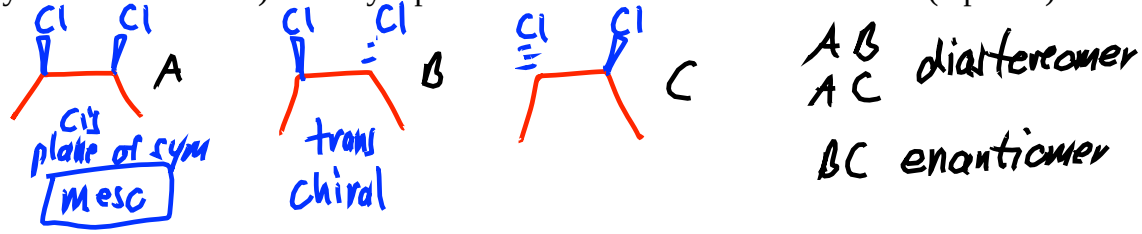








17a. a) Draw all the unique stereoisomers of 2,3-dichlorobutane. Cross out any duplicates.
b) Identify which is meso. c) Identify a pair that are related as diastereomers. (5 points)



18. Draw the mechanisms for the following reactions, <u>using formal arrow pushing</u>. Note: in some case hydrogens that are not illustrated will be involved in bond changes. You would do well to write them in at the beginning. (12 points total, 3/3/6 distribution)