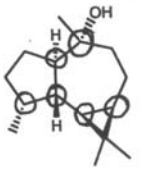
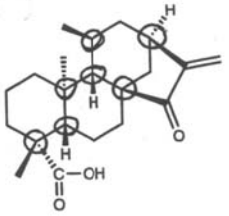
Problem Set #2 Chem 260

1. Circle all of the stereogenic centers in the following molecules.

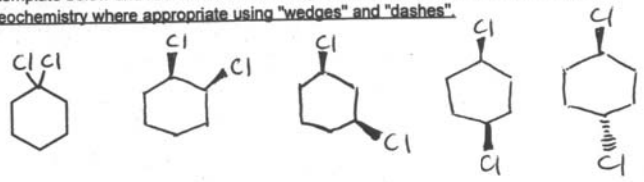
a)



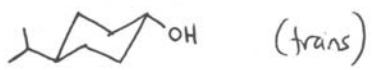
b)



2. Draw all the achiral (optically inactive) isomers of dichlorocyclohexane ($C_6H_{10}Cl_2$). Start with the template below and redraw it as necessary. Draw each isomer only once and show stereochemistry where appropriate using "wedges" and "dashes".



3. a) Draw the **most** stable stereoisomer of 4-isopropylcyclohexanol shown in its **most** stable conformation.



(trans)

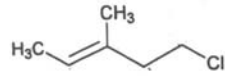
b) Draw the **least** stable stereoisomer of 4-isopropylcyclohexanol shown in its **most** stable conformation.

equatorial →

(Cis)

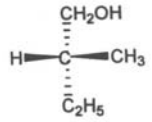
4. Name the following compounds using IUPAC nomenclature, including as necessary designation of stereochemistry.

a)



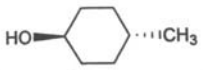
(E)-5-chloro-3-methyl-2-pentene

b)



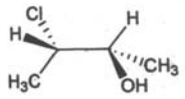
(R)-2-methyl-1-butanol

c)



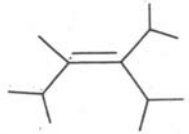
trans-4-methylcyclohexanol

d)



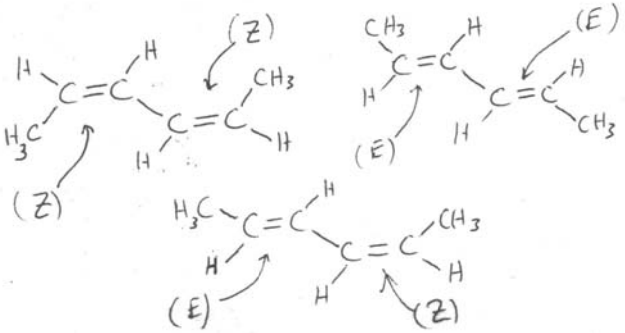
(2S,3S)-3-chloro-2-butanol

e)



4-isopropyl-2,3,5-trimethyl-3-hexene

5. Draw all possible stereoisomers of 2,4-hexadiene (CH3-CH=CH-CH=CH-CH3). For each double bond indicate whether the stereochemistry is (E) or (Z).

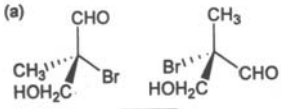


6. Shown below are a number of pairs of structural formulas. In the box below each pair, place the number (related to one of the terms listed below) that best describes the relationship between the two structures.

NOTE: Each term may be used more than once and not all of the terms need be used.

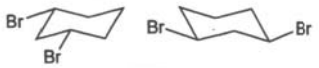
1. constitutional isomers
2. diastereomers
3. identical
4. enantiomers

(a)



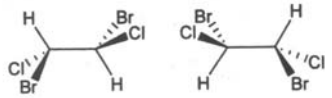
3

(b)



3

(c)

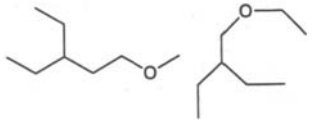


3 (HINT: MESO)

(d)

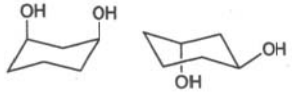
1

(e)

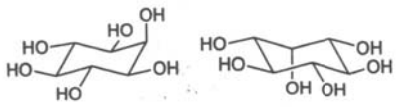


1

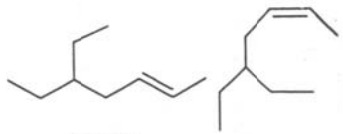
(f)



2

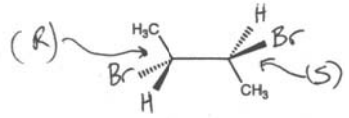


3

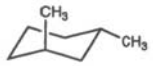


2

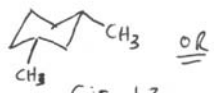
7. Draw the meso form of 2,3-dibromobutane using the template below. Indicate the absolute configuration of each stereogenic center using (R)/(S) nomenclature.



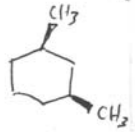
8. Draw a diastereomer of the compound shown below.



trans-1,3

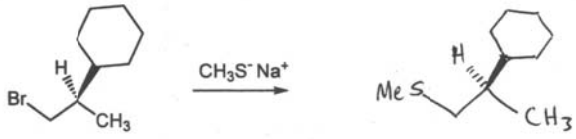


OR



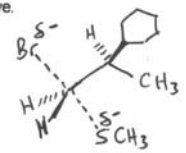
Cis-1,3

9. a) Draw the product(s) of the following reaction involving $CH_3S^-\ Na^+$ and the (*R*)-enantiomer of compound **1**. Show stereochemistry where appropriate.



(*R*)-**1**

b) Draw the transition state for the reaction shown above.

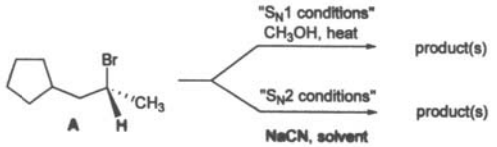


c) If the concentration of (*R*)-**1** is doubled and the concentration of $CH_3S^-\ Na^+$ is halved, what will happen to the overall rate of reaction? Explain your answer briefly.

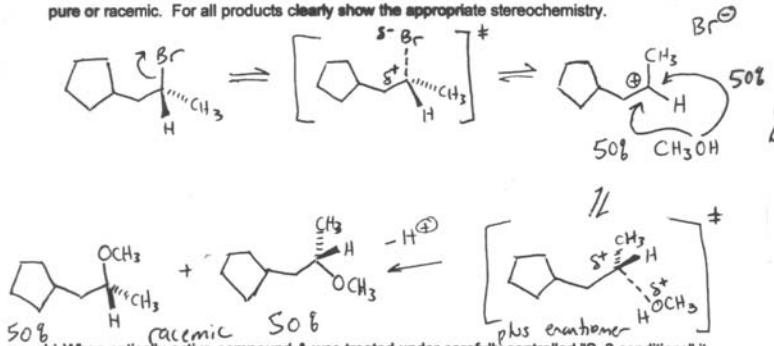
The overall rate will stay the same since the rate of this S_N2 reaction is dictated by:

$$rate = k[1][CH_3S^{\ominus}Na^+]$$

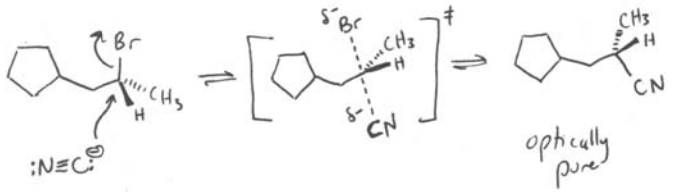
10. Secondary alkyl halides, such as compound A, may undergo either an S_N1 or S_N2 reaction depending upon the specific reaction conditions.



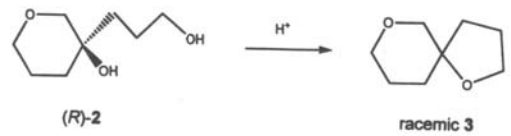
a) When optically active compound A was treated under carefully controlled "S_N1 conditions" it reacted solely via an S_N1 reaction. Write the product(s) and mechanism for this reaction, being careful to show any intermediates and transition states and state if the product(s) is/are optically pure or racemic. For all products clearly show the appropriate stereochemistry.

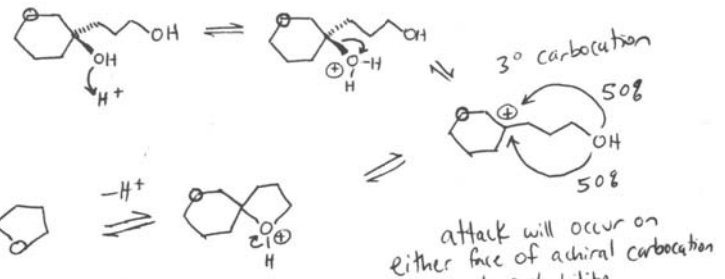


b) When optically active compound A was treated under carefully controlled "S_N2 conditions" it reacted solely via an S_N2 reaction. Write the product(s) and mechanism for this reaction, being careful to show any intermediates and transition states and state if the product(s) is/are optically pure or racemic. For all products clearly show the appropriate stereochemistry.



11) Propose a mechanism for the reaction of optically pure compound (*R*)-2 shown below Briefly explain why a racemic mixture of compound 3 is formed.





12) Propose a mechanism for the reaction below.