CHEM 3311 **HARRINGTON**

Exam 3 7:00 – 8:30 PM November 15, 2016 in MATH 100

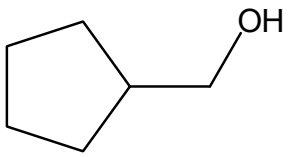
Instructions. No notes, books, laptops, phones, or calculators. Periodic Table, Electronegativity Chart, and 1,3-Diaxial Strain Table are provided.

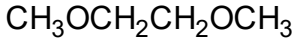
NAME:

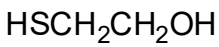
	Points Possible	Score
1	13	
2	10	
3	21	
4	15	
5	14	
6	17	
7	10	
Exam 2 Total Raw Score	100	
Curve		
Exam 1 Curved Score		
Exam 1 Letter Grade		

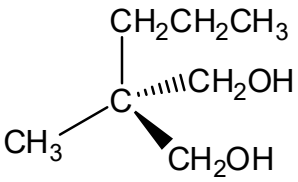
NAME of Recitation TA:

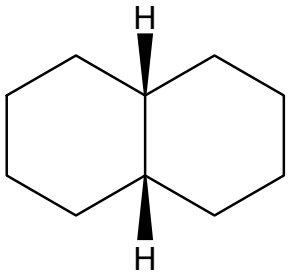
1 (**13 points**) Name each of the following compounds using IUPAC substitutive nomenclature.











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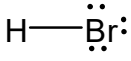
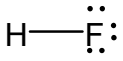
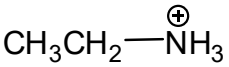
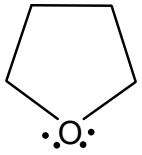
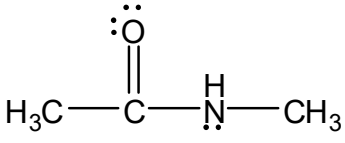
2. (**10 points**) Label each of the following molecules as a hydrogen bond acceptor, donor, or both. Label a hydrogen atom that is donated with a **D**. Label an atom that serves as the hydrogen-bond acceptor with an **A**.

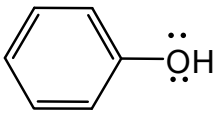


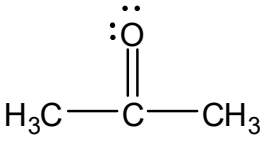












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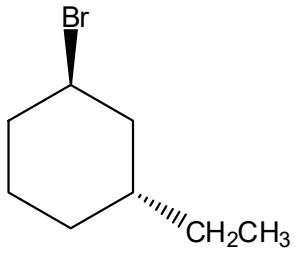
3. (**21 points**)

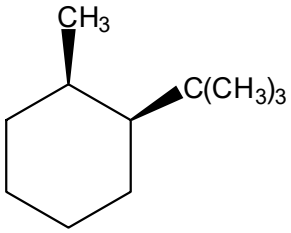
a. Identify each flat-ring structure as chiral or achiral. Explain in ten words or less.

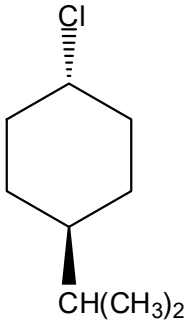
b. Draw a chair conformation corresponding to the flat-ring structure.

c. “Flip” the chair and draw a structure for the alternative chair conformation.

d. Determine the 1,3-diaxial strain (kcal/mol) for each chair using the data (**Table)**.







4. (**15 points**) For each of the following reactions, predict which one is faster and explain your prediction.

a. $(CH_3)_2CHCH_2Cl + N_3^- \xrightarrow[CH_3CH_2OH]{} (CH_3)_2CHCH_2N_3 + Cl^-$

$(CH_3)_2CHCH_2I + N_3^- \xrightarrow[CH_3CH_2OH]{} (CH_3)_2CHCH_2N_3 + I^-$

Explanation:

b. $CH_3CH_2CH_2CH_2Br + HS^- \longrightarrow CH_3CH_2CH_2CH_2SH + Br^-$

$CH_3CH_2\underset{\displaystyle CH_3}{\underset{|}{C}}HCH_2Br + HS^- \longrightarrow CH_3CH_2\underset{\displaystyle CH_3}{\underset{|}{C}}HCH_2SH + Br^-$

Explanation:

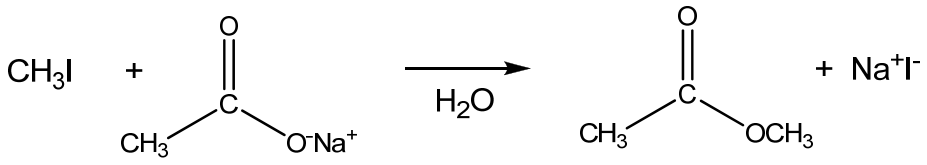
c. $(CH_3)_2CHCl + NH_3 \longrightarrow (CH_3)_2CHNH_3^+ Cl^-$

$CH_3CH_2CH_2Cl + NH_3 \longrightarrow CH_3CH_2CH_2NH_3^+ Cl^-$

Explanation:

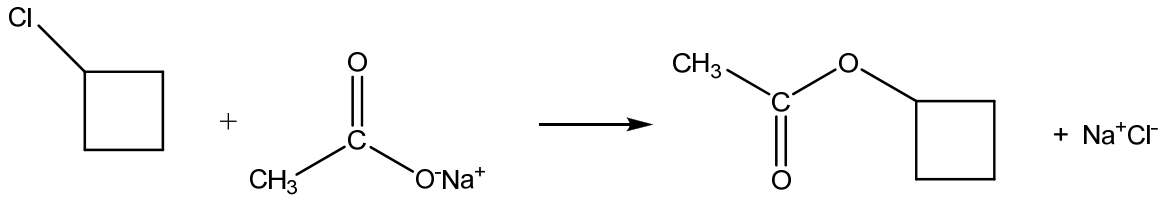
4. (continued)

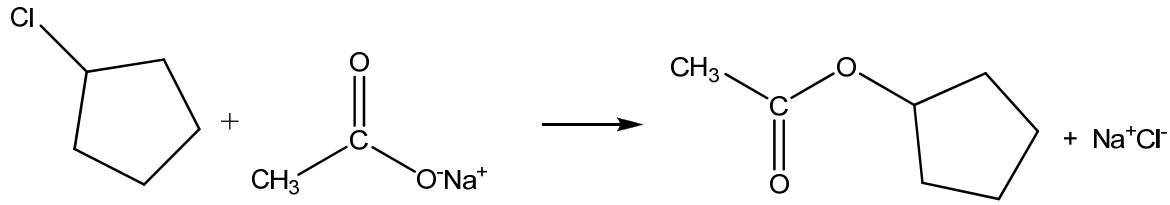
d. $CH_3I + Na^+OH^- \xrightarrow[H_2O]{} CH_3OH + Na^+I^-$



Explanation:

e.





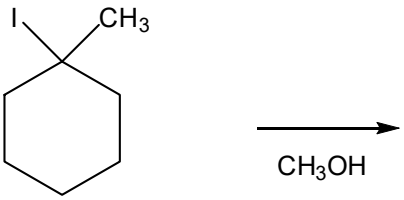
Explanation:

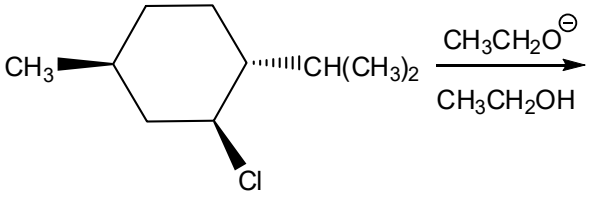
5. (**14 points**) Explain each of the following observations. Your explanation should include 1) the structures corresponding to the names in the reaction description, 2) the complete mechanism (with curved arrows to track the electron pairs) for each reaction, and 3) an explanation (in twenty words or less) for the observed results based on the mechanism.

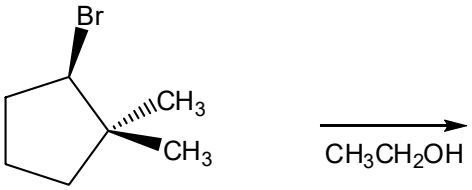
a. (S)-3-Bromo-3-methylhexane reacts with H_2O in acetone solvent to give a 1:1 mixture of the enantiomers of 3-methyl-3-hexanol.

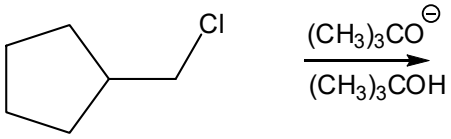
b. (R)-2-Bromo-2,4-dimethylhexane reacts with H_2O in acetone solvent to give (R)-2,4-dimethyl-2-hexanol.

6. (**16 points**) Assign a mechanism (E1 or E2) for each of the elimination reactions below. Draw structures for the alkenes formed in each reaction. If more than one alkene is formed in the reaction, predict which alkene will be the major component of the mixture.



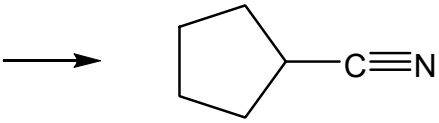




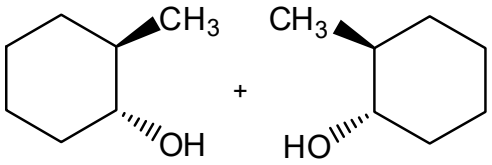


7. (**10 points**) Using reactions discussed in Chapters 7-9, design a two-step synthesis of each **Target Molecule** from the starting material provided. List the reagent(s) you will use and draw a structure for the product of each step.

(*Hint:* Work backwards from the **Target Molecule**.)

a. cyclopentane 

Target Molecule

b. 1-bromo-1-methylcyclohexane 

Target Molecule
1:1 mixture