CHEM 3311 **HARRINGTON**

Exam 3 7:00 – 8:30 PM April 18, 2017 in HUMN1B50

Instructions. No notes, books, laptops, phones, calculators, models or drawing stencils.

Periodic Table, electronegativity chart, and Table of Nucleophile/Base pK_b Values are provided.

NAME: **KEY** **Recitation TA Name:**

	Points Possible	**Score**
1	16	
2	16	
3	15	
4	12	
5	16	
6	14	
7	11	
Exam 3 Total Raw Score	100	
Curve		
Exam 3 Curved Score		
Exam 3 Letter Grade		

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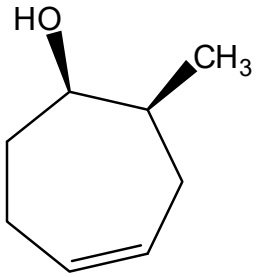
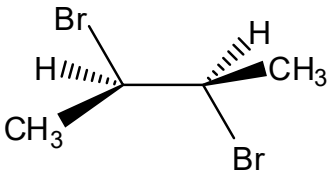
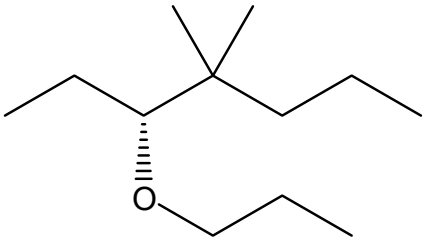
1(**16 points**). Draw a structure corresponding to each IUPAC name. The structure should show the R or S stereochemistry at each chiral C.



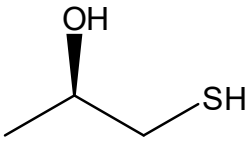
(1R,2S) 2-methyl cyclohept-4-enol
1 1 1 1 1



(2R,3R) 2,3-dibromo butane
1 1 1 1



(R) 4,4-dimethyl 3-propoxy heptane
1 1 1 1



(R) 1-mercapto propan-2-ol
1 1 1

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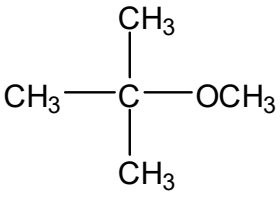
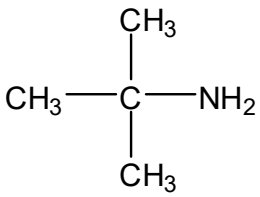
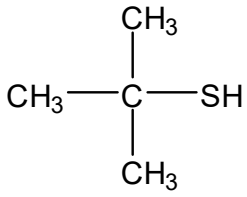
2. (**16 points**) For each set of three compounds, indicate which compound is most water-soluble and which is least water-soluble.

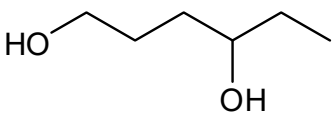


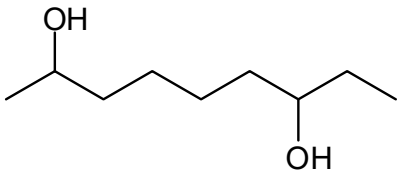


most
2

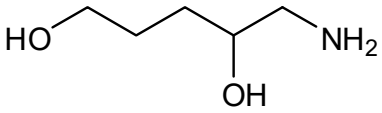


least
2

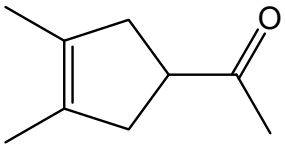




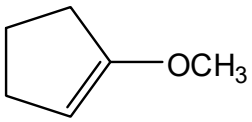
least
2

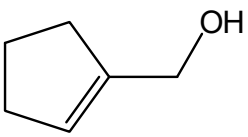


most
2

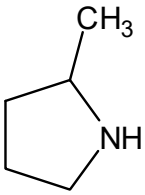


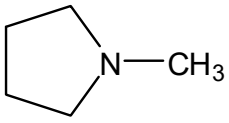
least
2



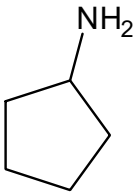


most
2





least
2



most
2

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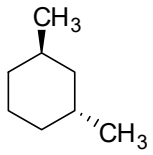
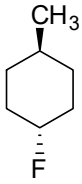
#
#
#
#

3. (**15 points**) Part A. Label each cyclohexane as chiral or achiral.



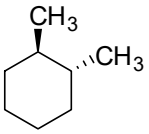
A

chiral
1



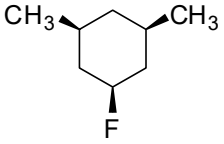
B

achiral
1



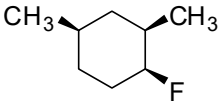
C

chiral
1



D

achiral
1



E

chiral
1

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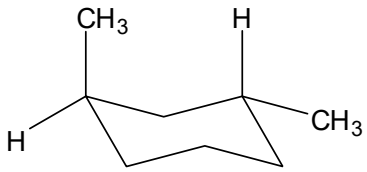
TA: circle the “a” of each achiral

Part B. Draw the most stable chair conformation for each cyclohexane from Part A.
(NOTE: You can use the back of the previous page to practice drawing chair structures but the structure to be graded must be drawn in the space provided below.)

no partial credit

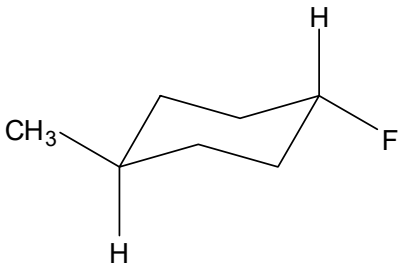
A



CH_3 ax CH_3 eq
CH_3 β to CH_3 α cw

2

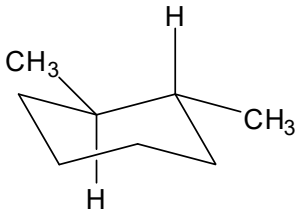
B



CH_3 eq F eq

2

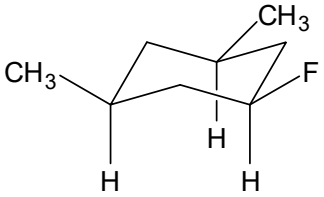
C



CH_3 eq CH_3 eq
CH_3 β to CH_3 α cw

2

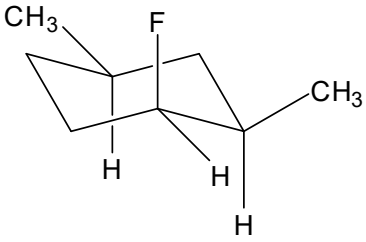
D



CH_3 eq CH_3 eq F eq

2

E

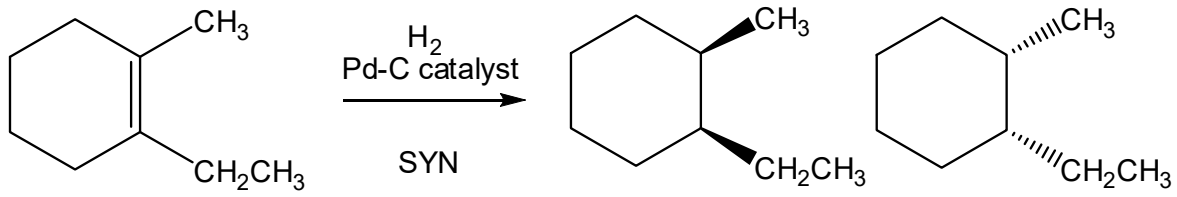


CH_3 eq CH_3 eq F ax
CH_3 β to CH_3 β to F β cw

2

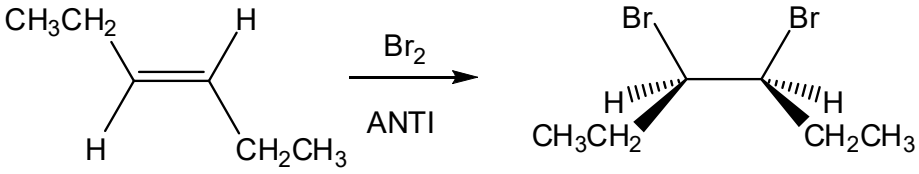
4. (**12 points**) Draw structures for the stereoisomeric products you would expect to form in each of the following reactions. Each structure should show the R or S stereochemistry at each chiral C.

no partial credit



2 2

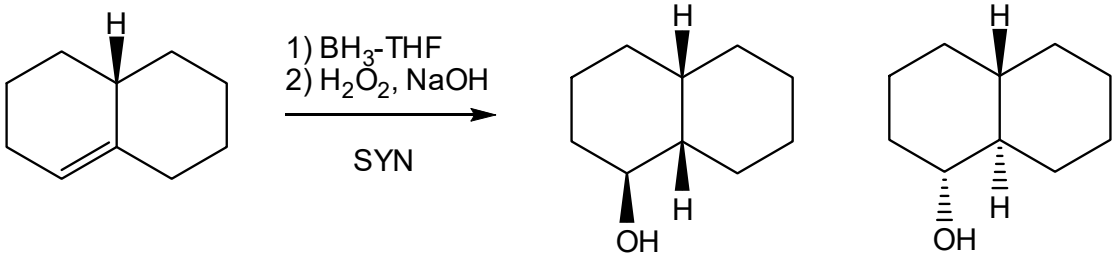
ANTI products also drawn -2 each



meso compound

4

SYN products also drawn -2 each



2 2

ANTI products also drawn -2 each
products w wrong regiochemistry -1 each

#

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#5. (**16 points**) For each pair of S_N2 reactions, identify the reaction with the faster rate. Explain each answer in ten words or less. (Suggested Practice Problems 14, 15, 16, 51)#

A. $CH_3Br + CH_3CH_2OH \xrightarrow[CH_3CH_2OH]{25^oC} CH_3CH_2OCH_3 + HBr$

$CH_3Br + CH_3CH_2ONa \xrightarrow[CH_3CH_2OH]{25^oC} CH_3CH_2OCH_3 + NaBr$ faster 2

Explanation: $CH_3CH_2O^-$ is a more reactive nucleophile than CH_3CH_2OH. (An anion is more reactive than the conjugate acid.) 2

B. $CH_3CH_2I + CH_3COOK \xrightarrow[acetone]{25^oC} CH_3COOCH_2CH_3 + KI$ faster 2

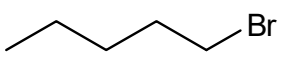
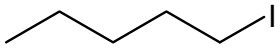
$CH_3CH_2I + CH_3COOK \xrightarrow[CH_3CH_2OH]{25^oC} CH_3COOCH_2CH_3 + KI$

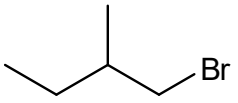
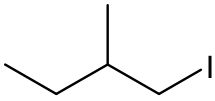
Explanation: Acetone is a polar aprotic solvent. Ethanol is a polar protic solvent. The anion is less solvated/more naked and more reactive in the polar aprotic solvent. 2

C. $CH_3I + N(CH_2CH_3)_3 \xrightarrow[CH_3CH_2OH]{25^oC} CH_3\overset{\oplus}{N}(CH_2CH_3)_3\ \overset{\ominus}{I}$

$CH_3I + P(CH_2CH_3)_3 \xrightarrow[CH_3CH_2OH]{25^oC} CH_3\overset{\oplus}{P}(CH_2CH_3)_3\ \overset{\ominus}{I}$ faster 2

Explanation: N and P are both from Column 5A of the periodic table. P is below N so P is larger. The P nucleophile is more polarizable and more reactive. 2

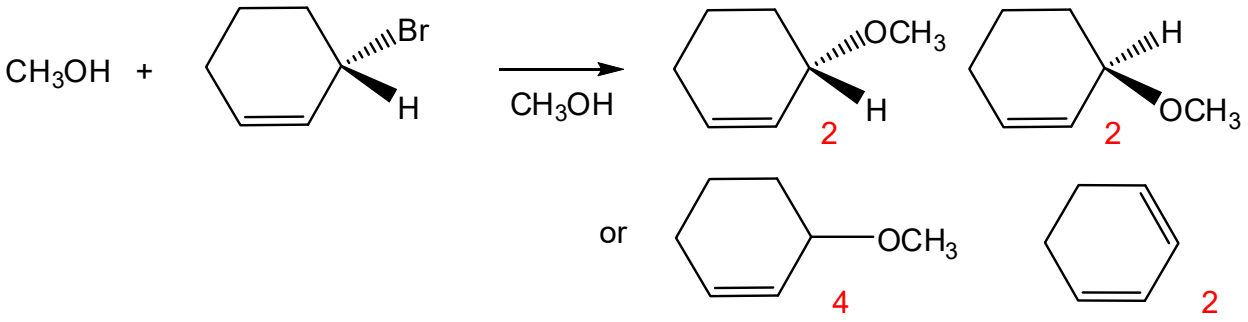
D.  + KI $\xrightarrow[acetone]{25^oC}$  + KBr
faster 2

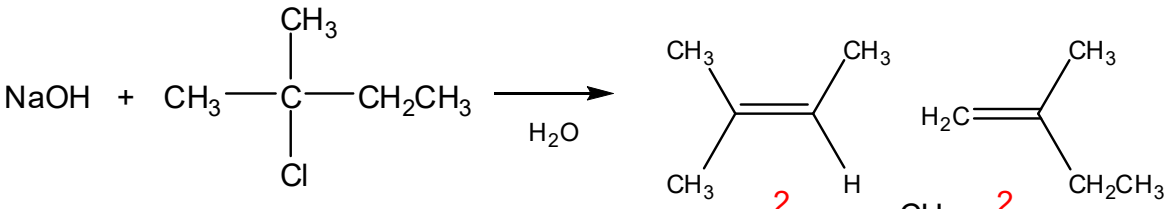
 + KI $\xrightarrow[acetone]{25^oC}$  + KBr

Explanation: The β-C in 1-bromo-2-methylbutane is 3°/more branched. β-Branching increases steric strain in the S_N2 transition state. 2

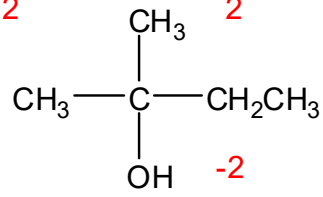
6. (**14 points**) Draw structures for the major organic product(s) formed in each reaction. Each product structure should clearly show the stereochemistry expected at each chiral C.

no partial credit



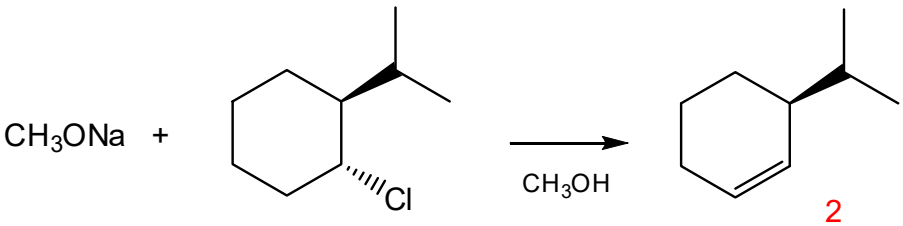


NOT a major product:

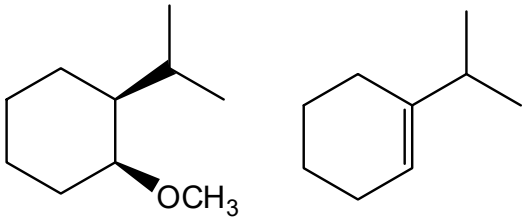


-2

NOT a major product: $CH_2=CH-CH_2OCH_2CH_3$ -2



NOT major products:



-2 -2

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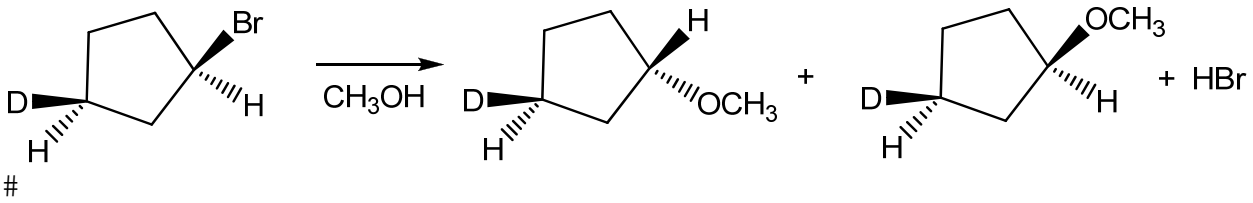
7. (**11 points**) Draw a complete step-by-step mechanism to account for the formation of both products. Use two-electron arrows to track the movement of electrons in each step.



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Mechanism