CHEM 3311-200 (Ellison/Richardson) 3rd Exam – April 16, 2013

Your Name KEY

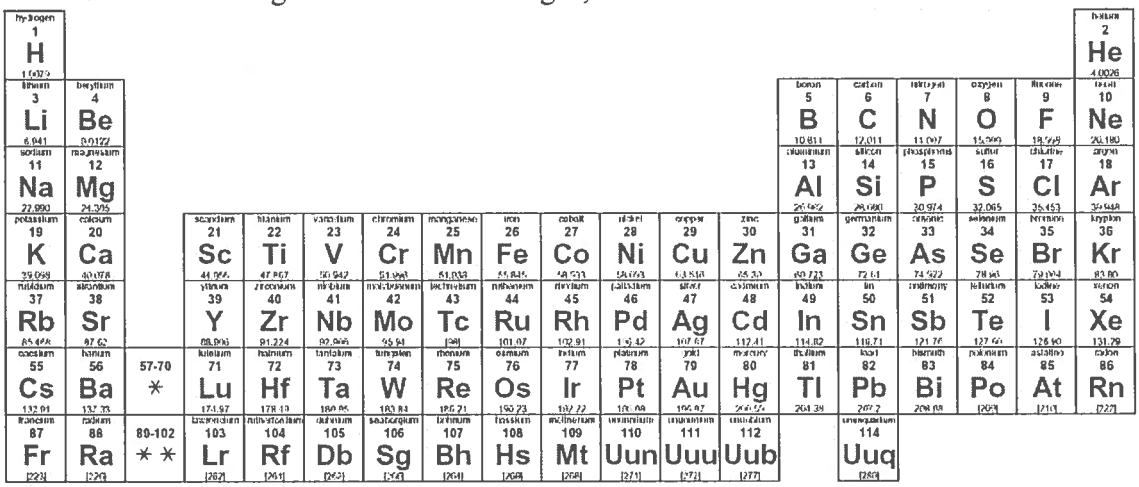
Student ID No. _____

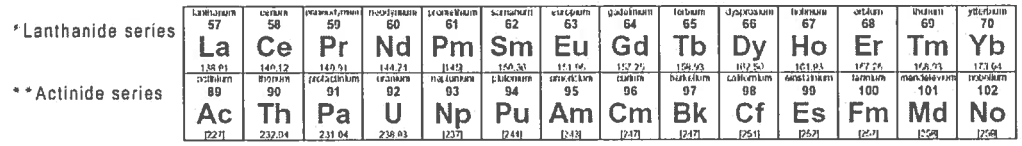
Recitation Day/Time _____

Recitation TA (circle one) Katelyn Chando, Setareh Azarnoush

Question	Score	Out of
1		12
2		10
3		12
4		12
5		16
6		16
7		12
8		10
Total		100

This is a closed-book exam. The use of notes, calculators, scratch paper, or cell phones will not be allowed during the exam. You may use models sets brought in a clear ziplock bag. Use the backs of the pages for scratch work. Please put all your final answers on the test in pen, not pencil. If your final answer is not clearly specified, you will lose points. For mechanisms, show all intermediates including correct formal charges, but do not show transition states.





Average: 62.0
Median: 66.0
St Dev: 22.2
Max: 96
Min: 9

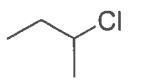
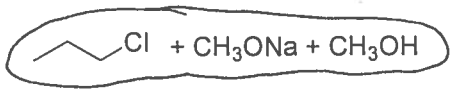
pKa Values

HI	-10	HN_3	4.7	H_2O	15.7
HBr	-8	H_2S	7.0	Alcohol (ROH)	16-18
HCl	-6	NH_4^+	9.3	HC≡CH	26
H_3O^+	-1.7	HCN	9.4	Amines (e.g. LDA)	36
HF	3.2	Phenol	10	$H_2C{=}CH_2$	45
CH_3COOH	4.7	RSH	10-12	CH_4	60

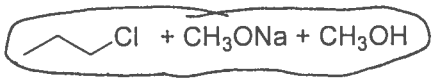
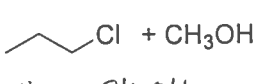
Name Key

1) For each of the following pairs of reactions, circle the one that would be faster at S_N2 and explain why in under ten words. If both are equal, do not circle an option. (3 pts each)

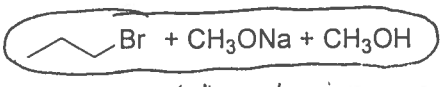
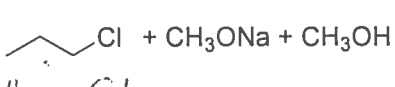
1 pt for circle, 2 pts for explanation.

a.  + CH_3ONa + CH_3OH (circled) 

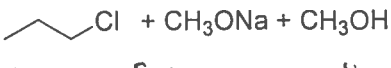
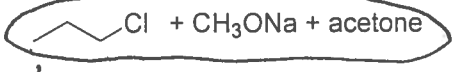
1° is faster than 2°

b. (circled)  

$CH_3O^{\ominus}$ is a better nucleophile than CH_3OH

c. (circled)  

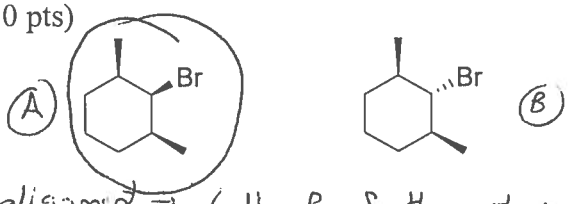
Br is a better leaving group than Cl.

d.  (circled) 

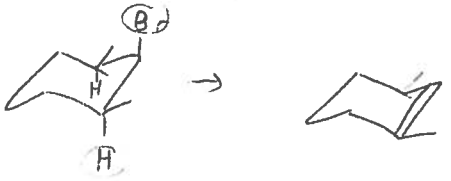
S_N2 is faster in aprotic solvents.

2) One of these molecules undergoes E2 elimination much faster than the other. Circle the faster molecule and explain why it is faster in under twenty words, but with as many structure drawings as you need. (10 pts)

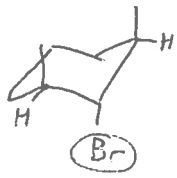
4 pts for circle
6 pts for explanation.



E2 requires antiplanar alignment → both Br & H must be axial.

A: 

→ E2 easy.

B 

→ No E2 possible in chair structure.

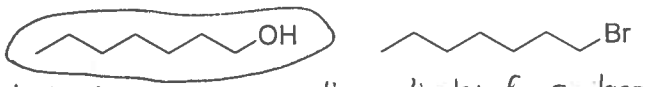
 Name Key

3) For each of the following pairs of reactions, circle the one with the higher boiling point and explain why it is higher in under ten words. (3 pts each)

1 pt for circle, 2 pts for explanation.

a. 

More OH groups = more H-bonding.

b. 

H-bonding is stronger than dipoles for similar-sized molecules

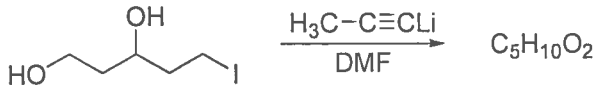
c. 

Dipoles are stronger than van der Waals

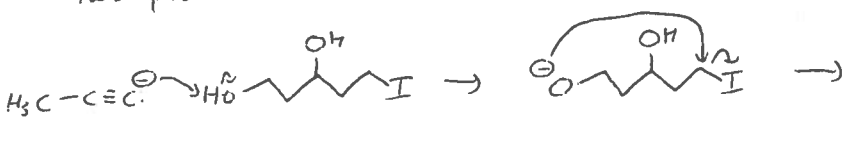
d. 

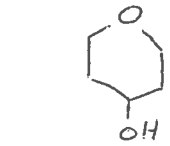
Stronger vdW forces from larger surface area.

4) When the compound shown below is exposed to $CH_3C{\equiv}CLi$ in DMF, a single product is formed with the formula $C_5H_{10}O_2$. Show the structure of this product and the mechanism that forms it. (12 pts)

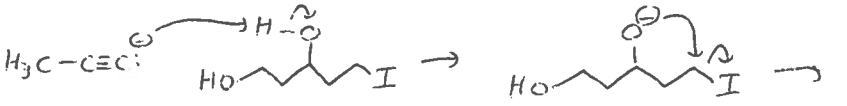


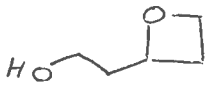
Two possibilities:





This forms a six-membered ring → good.

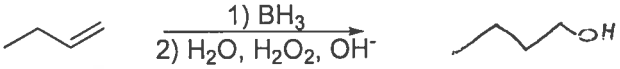


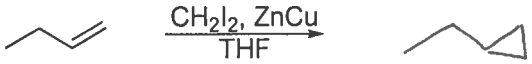


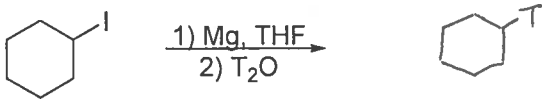
Four-membered ring → strongly disfavored & doesn't form.

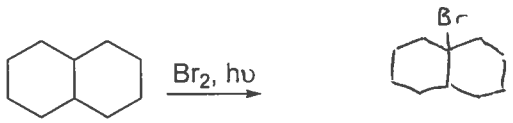
 Name Key

5) For each reaction shown below, predict the organic product(s). Ignore stereochemistry. (4 pts each)

a. 

b. 

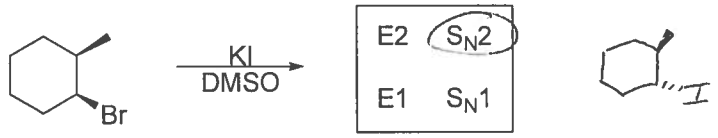
c. 

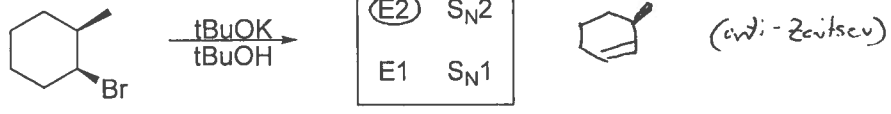
d. 

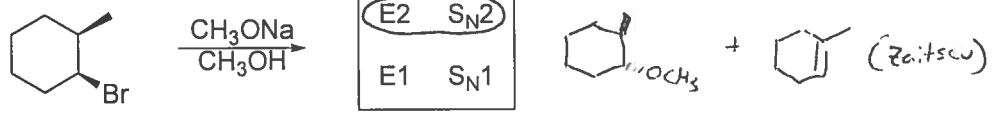
(Show monohalogenation products only)

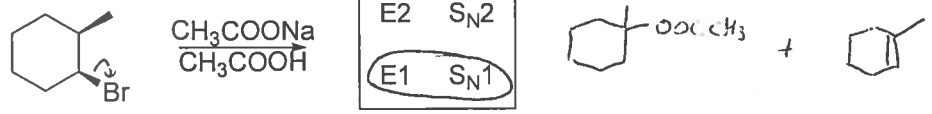
6) For each of the reactions shown below, **circle the mechanism(s)** you would expect to see, if any, and **draw the product(s)**. If a product has stereocenters, show its configuration using wedges and dashes. If an elimination occurs, show only the major alkene product. If none of the mechanisms would take place in a reasonable time frame, write NR for No Reaction. (4 pts each)

Each part:
2 points for mechanism(s)
2 points for product(s)

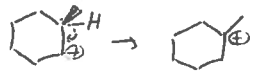
a. 

b. 

c. 

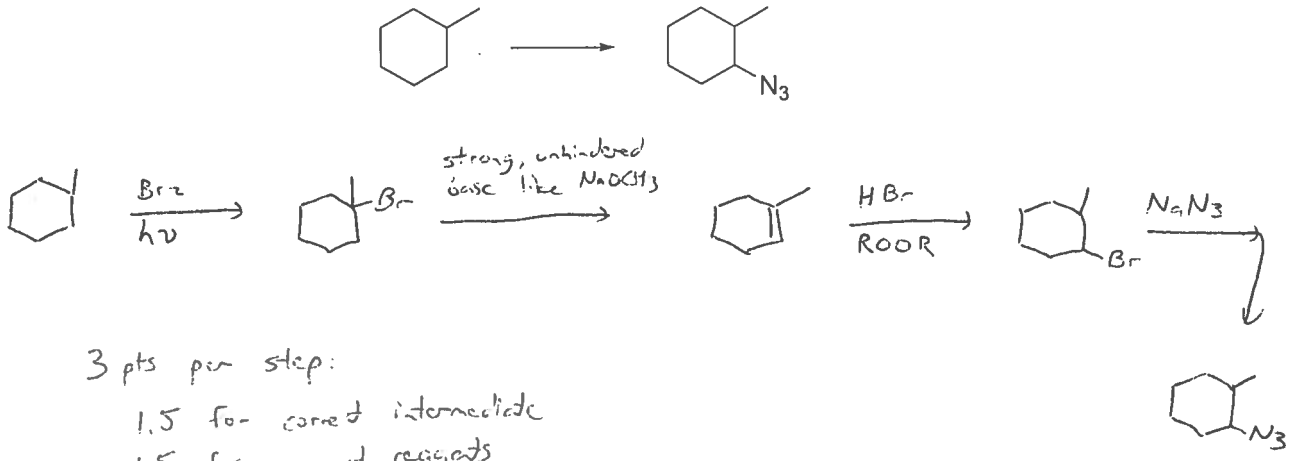
d. 

b)



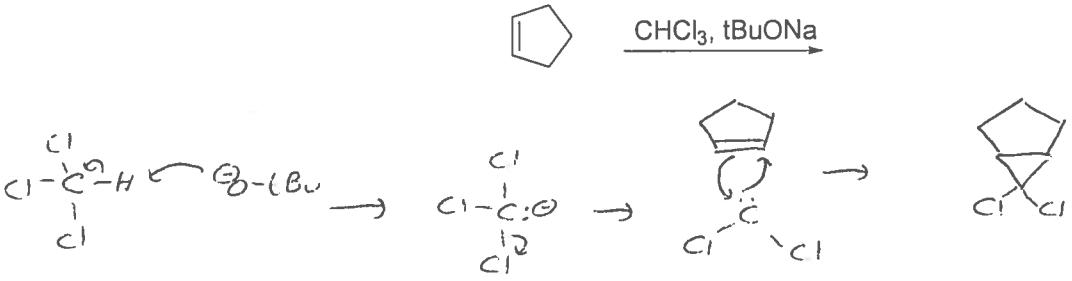
Name Key

7) Find a way to synthesize the desired product from the given starting material. If more than one step is necessary, show the product of each step. Do not show mechanisms. (12 pts)



3 pts per step:
1.5 for correct intermediate
1.5 for correct reagents

8) Show the mechanism and product of the following reaction. (10 pts)



2 pts for each mechanistic step
4 pts for product