Third Exam
CHEM 255 – Organic Chemistry I
Prof. Bastin
Summer 2016

Name Key

1. Provide *CLEAR, CONCISE* answers using unambiquous, carefully drawn structures and mechanisms for the appropriate questions. *Be sure to read each question VERY CAREFULLY.*
2. You may **ONLY** use a pen or pencil and the materials proyided in this packet on this exam.
3. If you have papers and/or books with you, they are to be left on the floor **AT THE FRONT OF THE ROOM**. If you need scrap paper please ask.
4. Cell phones must be **OFF and placed on the table at the FRONT of the ROOM**.

1) _____/16 pts 83%

2) _____/10 pts 50%

3) _____/14 pts 64%

4) _____/15 pts 92%

5) _____/10 pts 82%

6) _____/20 pts 88%

7) _____/15 pts 60%

Total: 76 /100 pts

$\bar{x} = 8.5$

med. 78

1) (16 pts) Indicate whether each of the following statements are true or false. Write T or F in the blanks below.

(a) An E1 reaction obeys first-order kinetics.

(b) Primary alkyl halides react faster than secondary alkyl halides in S_N2 reactions.

(c) The mechanism of an S_n2 reaction usually involves only one step.

(d) Carbocations are intermediates in an S_N1 reaction.

(e) The rate of an S_N1 reaction is proportional to the concentration of the nucleophile.

(f) The rate of an S_N2 reaction only depends on the nature of the leaving group.

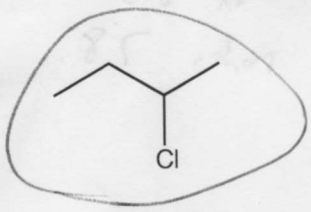
(g) An S_N2 reaction results in only inversion of configuration at the site of substitution.

(h) Alkyl substitution is the only important stabilizing factor in a carbocation intermediate.

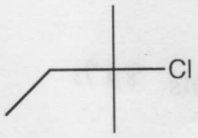
(a) T (b) T (c) T (d) T (e) F (f) F (g) T (h) F

2) (10 pts) For each of the following pairs, determine which compound would have a faster rate of S_N2. Provide an explanation for your choice.

(a)



2°

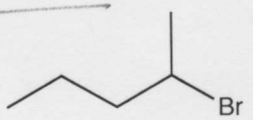


3°

2° reacts faster than 3° in S_n2 due to sterics

(b)

1°

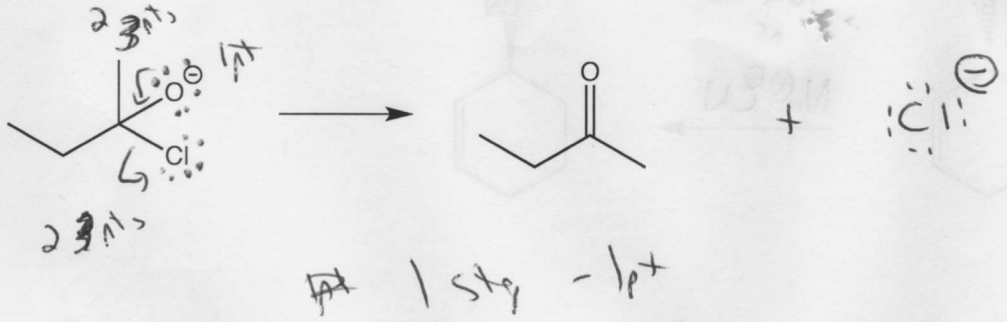


2°

1° react faster than 2° in S_n2 due to sterics

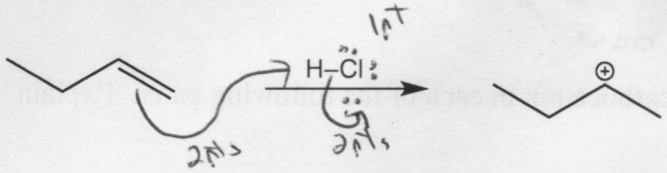
3) (14 pts) Provide the curved-arrow mechanisms for each of the following reactions. Also, indicate the Lewis Acid and Lewis Base of each reaction, when appropriate. Be sure to add any needed lone pairs to the structures. HINT: You may want to add hydrogens to the structures for clarity.

(a)



1 step - 1pt

(b)

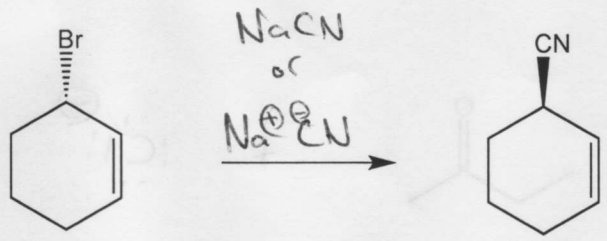


LB LA

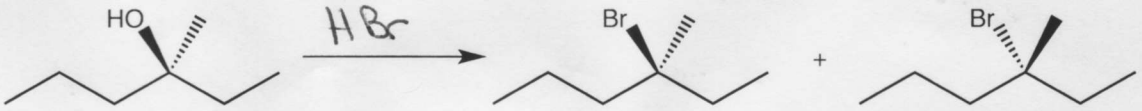
1 step - 1pt

4) (15 pts) Provide the reagents needed to bring about the following transformations.

a)

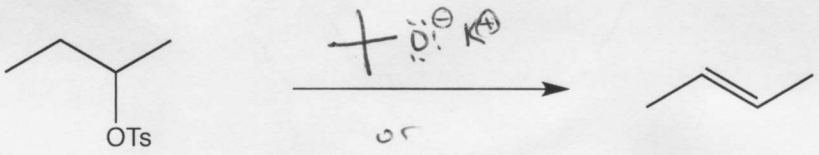


(b)



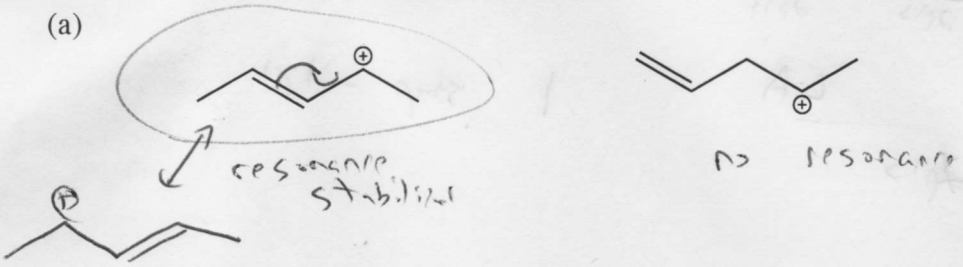
racemic mixture

(c)



5) (10 pts) Indicate the more stable carbocation in each of the following pairs. Explain.

(a)



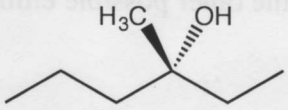
(b)

3° 2°

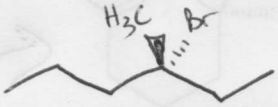
3° more stable than 2° due to additional alkyl group

6) (20 pts) Which product (or products) would you expect to be the major product(s) from each of the following reactions? In each reaction give the NAME of the mechanism (S_n1, S_n2, E1, E2) by which each product is formed.

(a)



$\xrightarrow[H_2O]{HBr}$



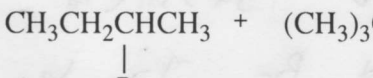
+

Sn1

Factor	Sn1	Sn2	E1	E2	
Nu				●	strong Nu weak base
[Nu]				●	
LG	✓		✓	✓	~~weak~~
Solvent	✓		✓		protic
Total	2		2	1	

Temp is Room T

(b)



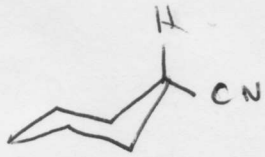
$\xrightarrow[(CH_3)_3COH]{50^oC}$

Factor	Sn1	Sn2	E1	E2	
Nu	●		●	✓	~~weak~~ Nu strong base
[Nu]		✓		✓	
LG	✓	✓	✓	✓	
Solvent	✓		✓		protic
Total	2	2	2	3	

E2 3pt, trans 1pt, regiochem 1pt

(c)

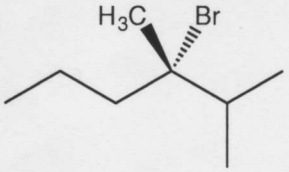
+ NaCN $\xrightarrow[\text{acetone}]{50^oC}$



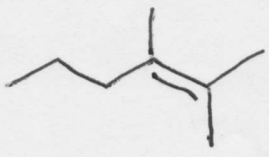
Factor	Sn1	Sn2	E1	E2	
Nu		✓			strong Nu weak B
[Nu]		✓			
LG	✓	✓	✓	✓	
Solvent		✓		✓	
Total	1	4	1	2	

Sn2

(d)



$\xrightarrow[CH_3OH]{50^oC}$



E1

Factor	Sn1	Sn2	E1	E2	
Nu	✓		✓		weak
[Nu]					
LG	✓		✓	✓	
Solvent	✓		✓		protic
Total	3		3	1	

Δ heat favors E1

E2

D is trans to Br

mechanism

7) (15 pts) When the deuterium-labeled compound shown below is subjected to elimination using sodium ethoxide in ethanol, the only alkene product is 3-methyl-cyclohexene. Provide an explanation for this result. Your explanation should include a curved-arrow mechanism and an explanation as to why this product is formed rather than the other possible elimination products.