CHEM 3311-200 **Assigned Seat # _____**

Exam 2 Key

March 8, 2016 **Time: 2 Hours**

Please ***sign*** the Honor Pledge.

I pledge that

"On my honor, as a University of Colorado-Boulder student, I have neither given nor received unauthorized assistance on this work."

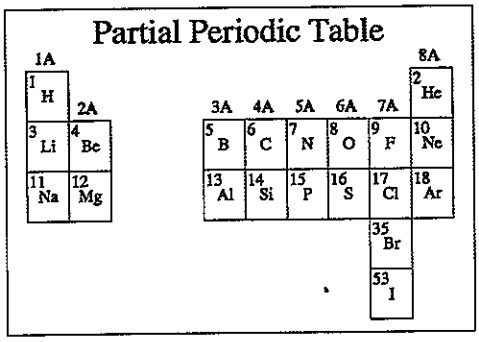
_____ _____

PRINT Last Name, First Name, Middle Initial Please Sign Here

Recitation TA's name: _____

Recitation Section # _____ **Recitation Day and Time:** _____

PLEASE legibly print your name on each page of the exam.



215	EKLC M2B36	Mon 1:00-1:50 PM	Matthew Farmer
227	EKLC M2B36	Tue 3:00-3:50 PM	Ethan Miller
234	EKLC M2B36	Wed 12:00-12:50 PM	Matthew Farmer
236	EKLC M2B36	Wed 2:00-2:50 PM	Ethan Miller
238	EKLC M2B36	Wed 4:00-4:50 PM	Thomas Carey
243	EKLC M2B36	Thu 11:00-11:50 AM	Aaron Crossman
245	EKLC M2B36	Thu 1:00-1:50 PM	Aaron Crossman

PLEASE read the questions very carefully!

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 brought in a clear ziploc bag.
Please put all your answers on the test in the appropriate place. Use the backs of the pages for scratch (there are two additional blank scratch sheets after the last page of the exam). **DO NOT PUT ANSWERS ON THE SCRATCH SHEETS.**

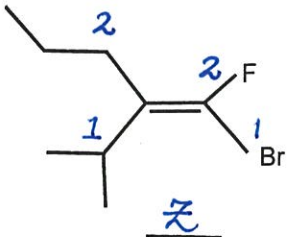
Table of Acidities

Acid	pK_a Value	Acid	pK_a Value
HI	–10	Thiol (RSH)	10-12
HBr	–8.5	H_2O	15.7
HCl	–6	Alcohol (ROH)	16-18
H_3O^+	–1.7	HC≡CH	26
HF	3.2	NH_3	36
CH_3COOH	4.7	H_2	37
HN_3 (hydrazoic acid)	4.7	$H_2C=CH_2$	45
NH_4^+	9.3	CH_4	60
Phenol	10		

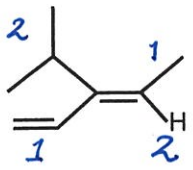
Grading (Points Earned)	
Question 1 (15)	____
Question 2 (15)	____
Question 3 (16)	____
Question 4 (20)	____
Question 5 (22)	____
Question 6 (12)	____
TOTAL (100)	____

Name: _____

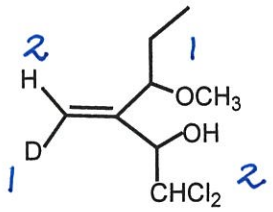
1. E/Z assignment (15 points)
(i) Rank each double bond substituent as priority 1 or 2 using the Cahn-Ingold-Prelog rules.
(ii) Provide the E or Z assignment for each molecule shown below.

(A) 

Z

(B) 

E

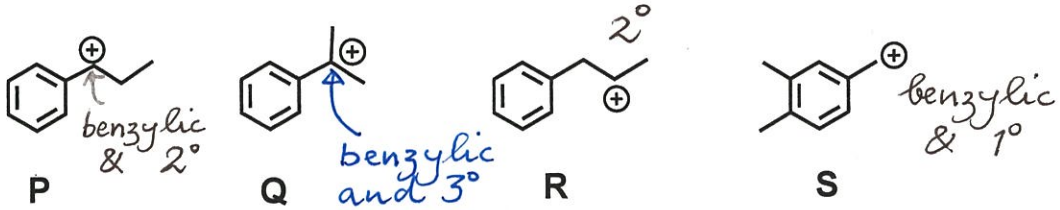
(C) 

E

2. Identify the ***most*** and ***least*** stable species in each series; write the appropriate letter in the spaces provided below. (15 points)

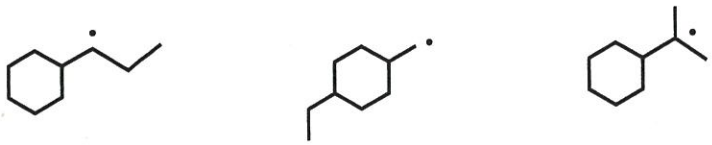
I) 
A B C D E

Most stable: C Least stable: D

II) 

P Q R S

Most stable: Q Least stable: R

III) 
X Y Z

Most stable: Z Least stable: Y

Points earned: ***Question 1*** _____/15 ***Question 2*** _____/15

Name: _____

3. Select the ***best*** reaction condition(s) for each transformation listed as **3(A)** to **3(D)**. (16 points)
*Please enter a letter **A – J** for the best condition(s).* (If it helps you, first enter the letter, followed by the best conditions.)

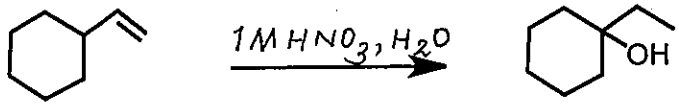
A) HBr
B) HBr, ROOR, heat
C) Br_2, CH_2Cl_2
D) Br_2, CH_3OH
E) BH_3, THF; then, H_2O_2, OH^-
F) $Hg(OAc)_2$, H_2O; then, $NaBH_4$, OH^-
G) O_3; then H_2O (+ H_2O_2)
H) O_3; then $(CH_3)_2S$
I) Br_2, H_2O
J) 1 M HNO_3, H_2O

3 (A)

anti Markovnikov addition of HBr.

Best condition(s): B

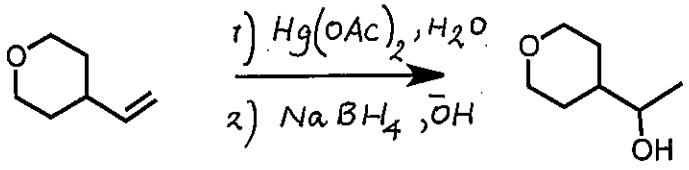
3 (B)



- carbocation mechanism;
- rearrangement of 2° carbocation to 3° carbocation by hydride shift

Best condition(s): J

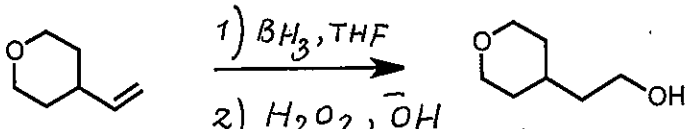
3 (C)



Markovnikov hydration of alkene

Best condition(s): F

3 (D)



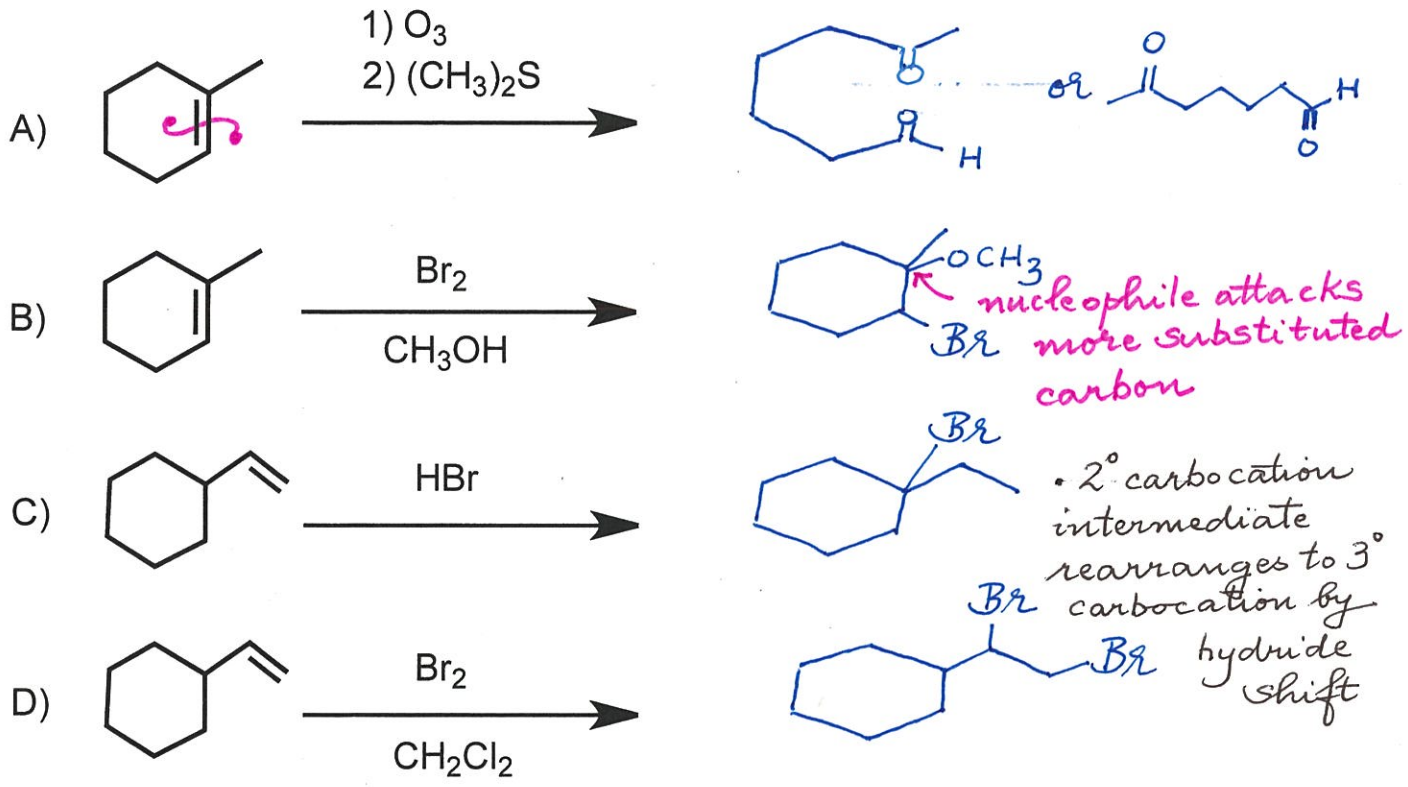
anti-Markovnikov hydration of alkene

Best condition(s): E

Points earned: ***Question 3*** _____/16

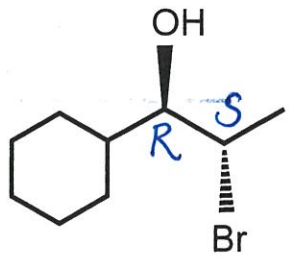
Name: _____

4. Draw the structure(s) for the major product(s) in each reaction; (stereochemistry is ***not*** required). (20 points)

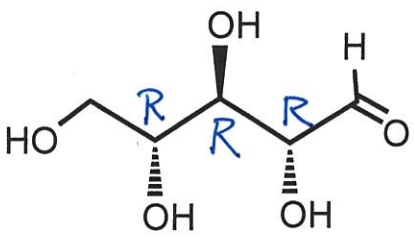


5. (**A**) Identify and carefully label each asymmetric carbon in these molecules using the R/S stereochemical configuration descriptors. (10 points)

(I)



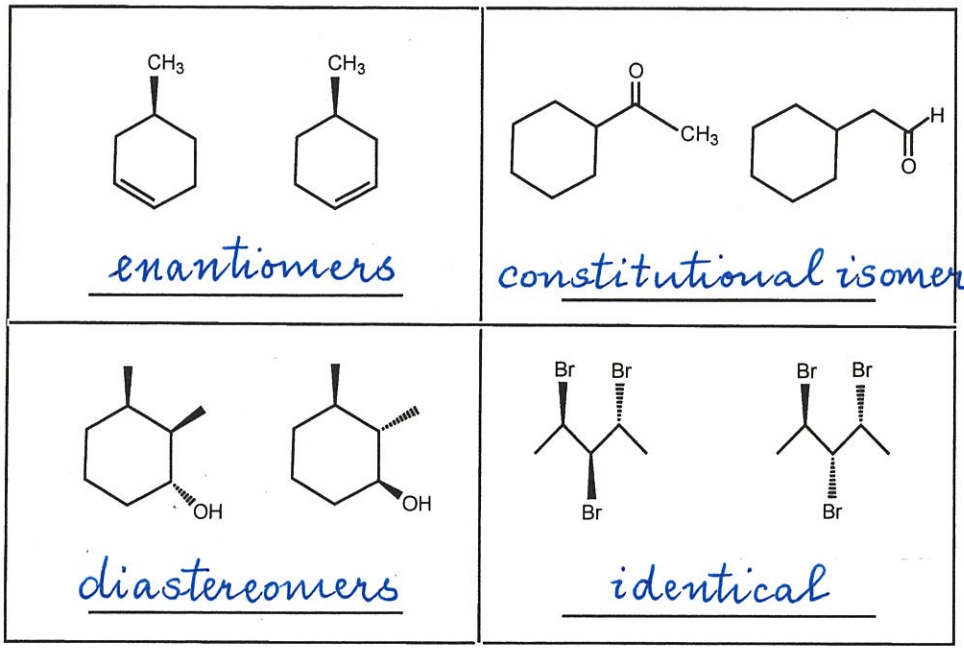
(II)



Points earned: ***Question 4*** _____/20 ***Question 5A*** _____/10

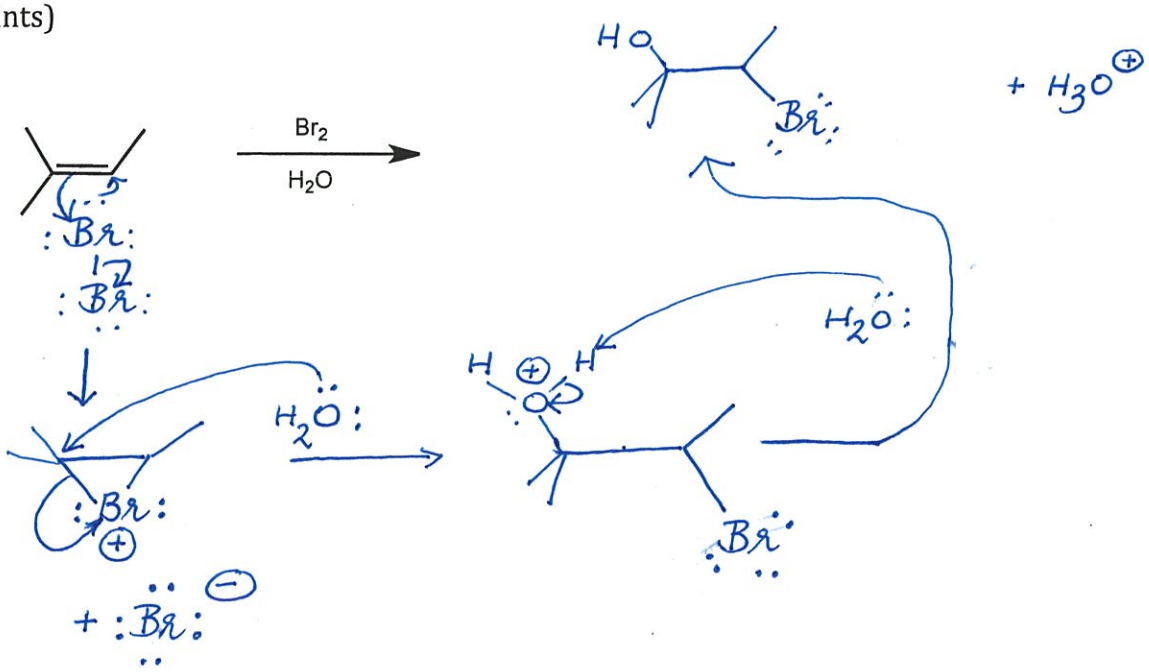
Name: _____

5 (**B**) Describe the relationship between each pair of molecules as constitutional isomers, diastereomers, enantiomers, or identical. (12 points)



6. Write the complete mechanism for the reaction shown below. You must show formal charges and lone pairs where appropriate. Circle the major product of your reaction. (6 points)

(A)

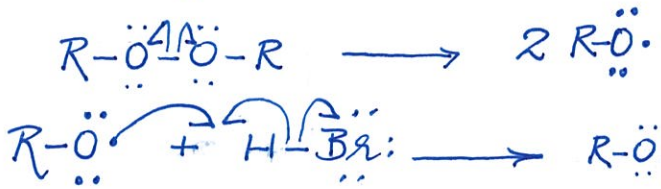


Points earned: ***Question 5B*** _____/12 ***Question 6A*** _____6

Name: _____

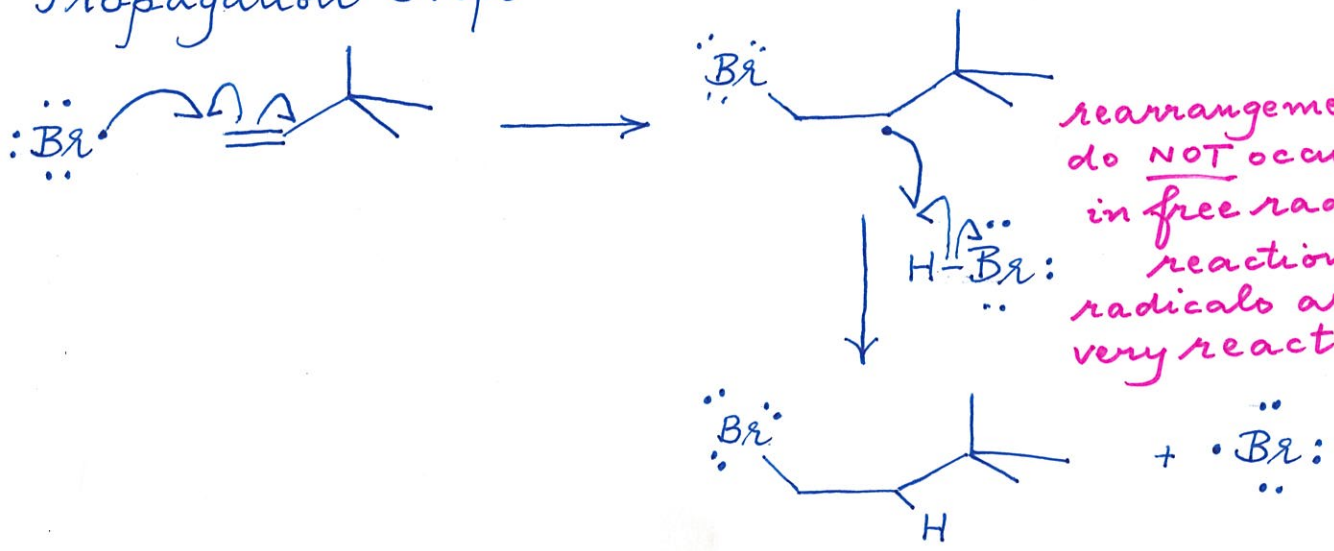
6 (B) Write the mechanism showing the (i) ***initiation*** and (ii) ***propagation*** steps for the reaction shown below. You must show formal charges and lone pairs where appropriate. Circle the major product of your reaction.

Initiation Steps



bromine radical reacts with π bond

Propagation Steps



rearrangements do NOT occur in free radical reactions; radicals are very reactive!

Points earned: ***Question 6B*** _____/6