CHEM 3311 (Richardson) Second Hour Exam – March 14, 2017

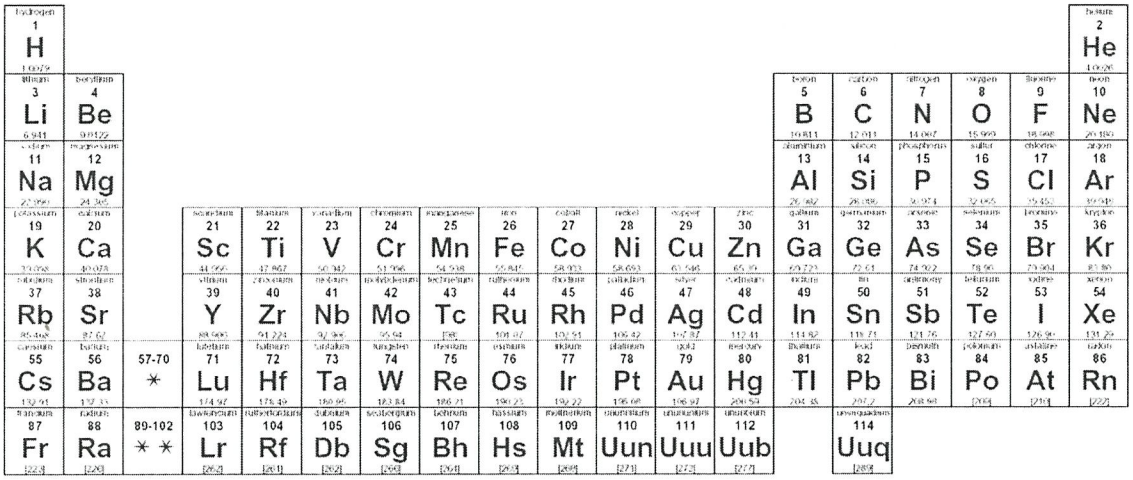
Your Name Key

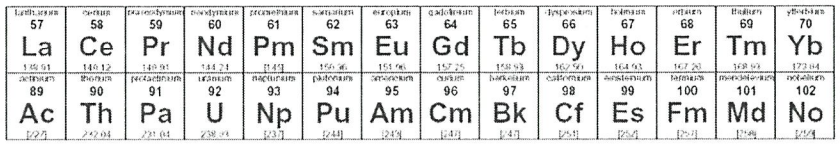
Student ID _____

Recitation Time (check one)
- O 8:00 Wednesday w/ Josh Kamps
- O 2:00 Wednesday w/ Josh Kamps
- O 10:00 Thursday w/ Brendan Griffiths
- O 11:00 Thursday w/ Brendan Griffiths
- O 12:00 Friday w/ Brendan Griffiths

Question	Score	Out of
1		20
2		10
3		15
4		10
5		25
6		20
7		10 e.c.
Total		100

This is a closed-book exam. The use of notes, calculators, 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. 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.



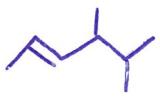
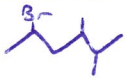
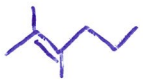
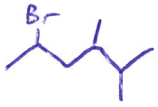
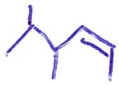
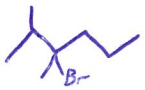


pKa Values

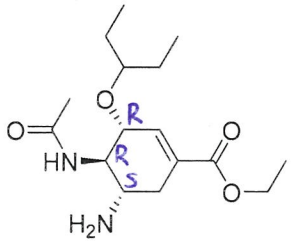
HI	-10	CH_3COOH	4.7	ArOH	10	H_2	35
HBr	-8	HN_3	4.7	RSH	10-12	NH_3	36
HCl	-6	H_2S	7.0	H_2O	15.7	$H_2C{=}CH_2$	45
H_3O^+	-1.7	NH_4^+	9.3	ROH (R=alkyl)	16-18	CH_4	60
HF	3.2	HCN	9.4	HC≡CH	26		

Average = 67.5 (8-pt curve)
St Dev = 15.6
max = 102 (before curve)
min = 26

1) Fill in the table below. For each compound name, draw the structure, rank its stability (1=most stable), and draw the major product(s) for this molecule reacting with HBr. (20 pts)

Name	Structure (1 pt)	Stability Ranking (1 pt)	Major product(s) formed by HBr addition (2 pts)
(*E*)-4,5-dimethyl-2-hexene		3	 (can also show  - not enough for full pts by itself)
(*E*)-2,3-dimethyl-3-hexene		2	
2,3-dimethyl-2-hexene		1	
4,5-dimethyl-1-hexene		5	
(*Z*)-4,5-dimethyl-2-hexene		4	 (can also show )

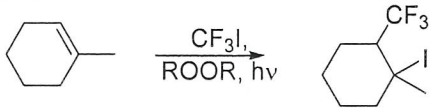
2) Tamiflu, shown below, is used for the prevention and treatment of flu. What is the absolute configuration at each of its asymmetric carbons? How many stereoisomers are possible for this molecule, ignoring E/Z stereochemistry at the double bond? (10 pts)

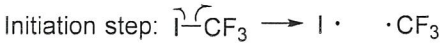


8 total stereoisomers.

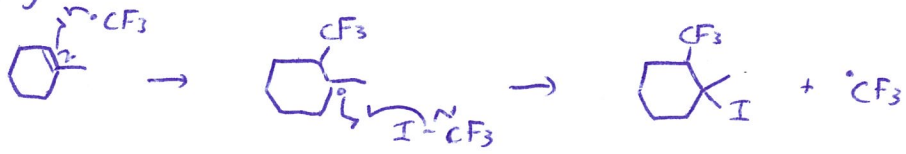
(2.5 pts per answer, rounding down.)

3) The reaction shown below is very similar to a reaction that we covered in lecture. Suggest a reasonable mechanism for this reaction. The initiation step is already shown, but give the propagation steps and at least two possible termination steps. (15 pts)



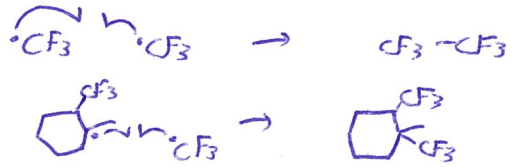
Initiation step: 

Propagation:

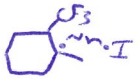


(Propagation starts & ends w/ same radical)

Termination:

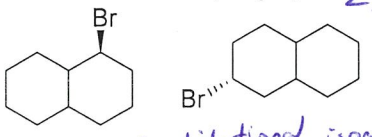


+ others (some based on ROOR radicals)

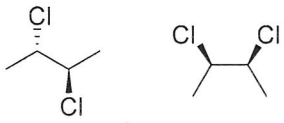
7 pts for propagation (-3 for forming radical in wrong place, -3 for showing termination to get major prod  -1 for each arrow out of place)

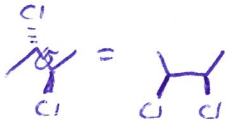
3 pts for each termination

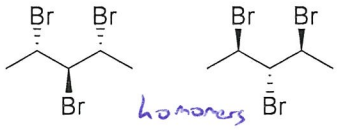
4) Describe the following pairs of molecules as homomers, enantiomers, diastereomers, or constitutional isomers. (10 pts) 2pts each.

a. 

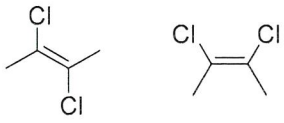
Constitutional isomers

b. 

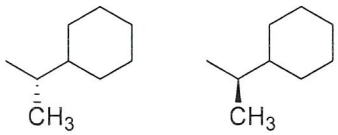
homomers 

c. 

homomers

d. 

Diastereomers

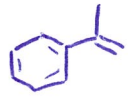
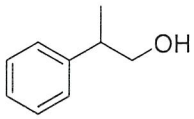
e. 

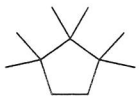
homomers - no stereocenter!

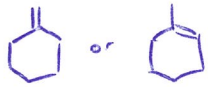
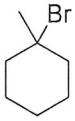
(CH_3 x 2 on C)

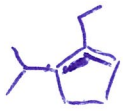
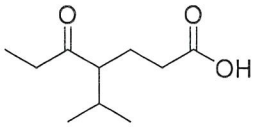
5) Starting from any hydrocarbon with the same number of carbon atoms as the product, and using any reactions that have been covered so far in class, show how you would create the products shown as the only major product of the reaction. Write your hydrocarbon starting material before the arrow, and the other reagents above or below the arrow. (25 pts)

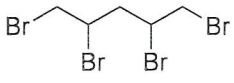
3 pts for starting material
2 pts for reagents

a.  1) BH_3 2) H_2O, H_2O_2, $^{\ominus}OH$ 

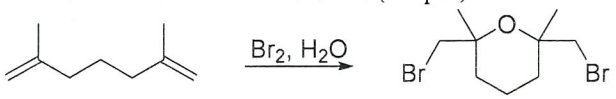
b.  H_2, Pd/C 

c.  HBr (no ROOR!) 

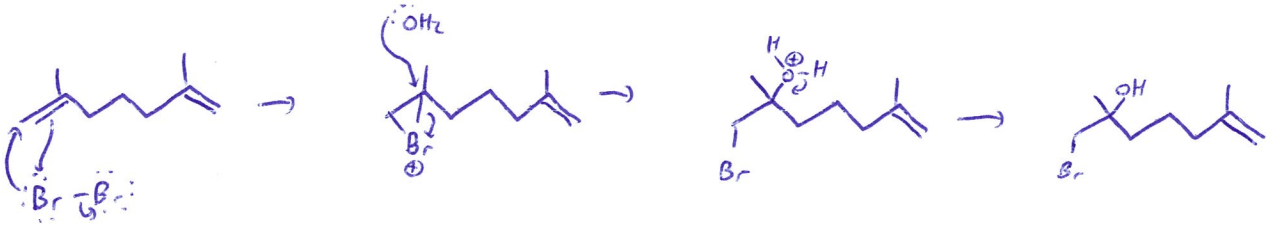
d.  1) O_3 2) H_2O_2 

e.  Br_2 (H_2O) 

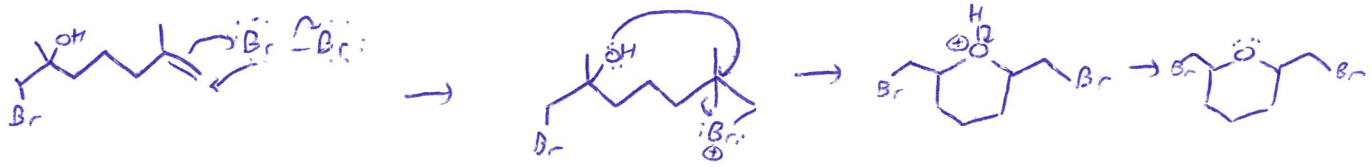
6) Suggest a reasonable mechanism for this reaction. (20 pts)



Halohydrin formation first:



Halo ether formation second:



-1 for minor errors (missing arrow or ⊕ charge on a mech that is otherwise okay)

+5/10/15/20 for mechs that are about ¼, ½, ¾, or fully correct. must at least follow the "flavor" of halohydrin formation for partial credit.

7) Extra credit! Using only C, H and O, draw the structures for the lowest-molecular-weight acyclic chiral molecule with the functional group listed. You do not need to show absolute configuration. (10 pts extra credit)

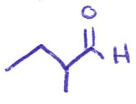
2 pts each. must be chiral & have correct FG or ~~not~~ no pts

a. Alkane

b. Ester

c. Alcohol

d. Aldehyde



e. Ketone