CHEM 3311 (Richardson) Second Exam – Oct. 22, 2019

Your Name: Key

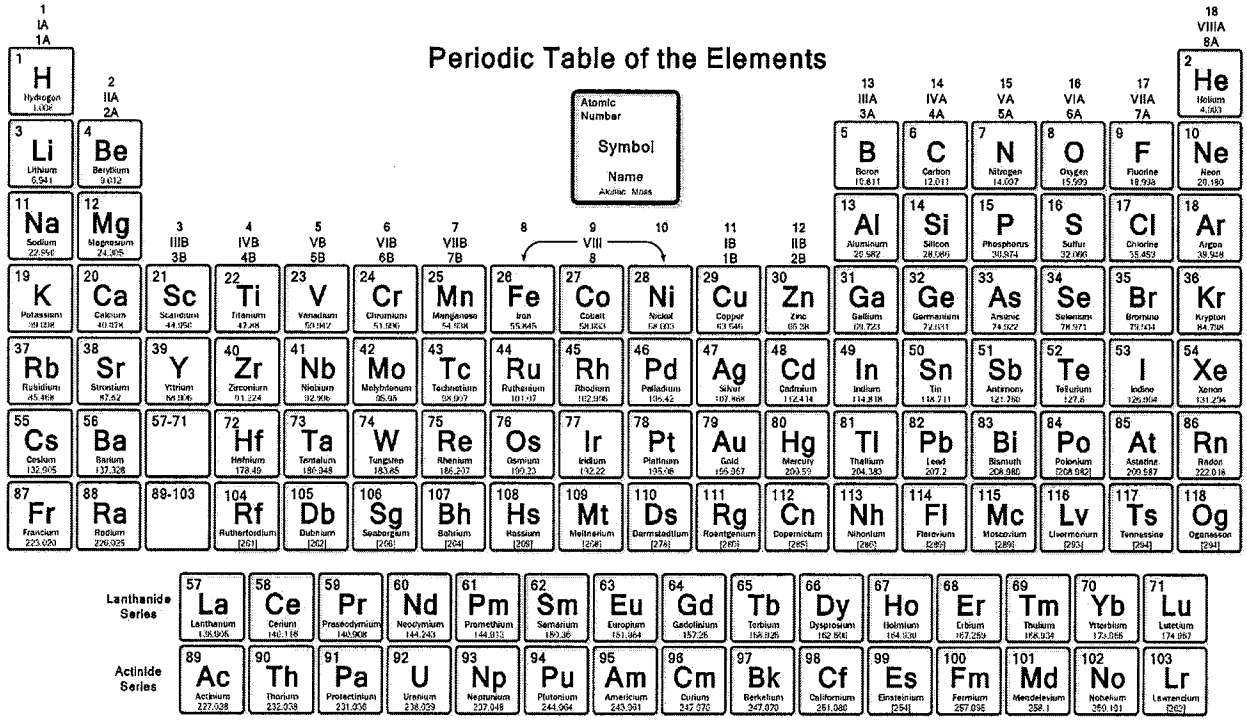
Student ID: _____

Recitation (check one)

O 10:00 Mon (Jonathan Thurston)
O 11:00 Mon (Andrew Chomas)
O 1:00 Mon (Shea O'Sullivan)
O 2:00 Mon (Shea O'Sullivan)
O 3:00 Mon (Dominique Blackmun)
O 8:00 Tue (John Flood)
O 9:00 Tue (Chance Brandt)
O 10:00 Tue (John Flood)
O 12:00 Tue (Jonathan Thurston)
O 2:00 Tue (Andrew Chomas)
O 3:00 Tue (Justin Olson)
O 4:00 Tue (Justin Olson)

Question	Score	Out of
1		10
2		12
3		25
4		18
5		10
6		25
7		10 ec
Total		

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.

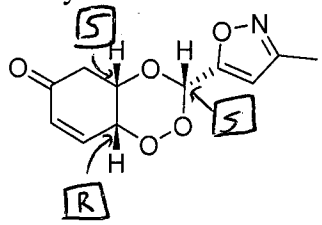


pKa Values

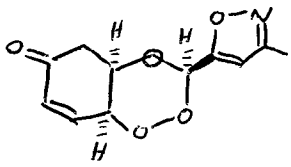
HI	-10	CH_3COOH	4.7	ArOH	10	HC≡CH	26
HBr	-8	HN_3	4.7	RSH	10-12	H_2	35
HCl	-6	H_2S	7.0	H_2O	15.7	NH_3	36
H_3O^+	-1.7	NH_4^+	9.3	ROH	16-18	$H_2C{=}CH_2$	45
HF	3.2	HCN	9.4	O=C-CH	9-25	CH_4	60

Average: 73.1
Curve: 2
St. Dev: 18.7
Max: 108
Min: 16.5

1) The compound shown below is an anticancer agent that is being investigated as a treatment for canine osteosarcoma. Assign the configuration of each asymmetric carbon and draw the enantiomer of this molecule. How many diastereomers does this molecule have? (10 pts)

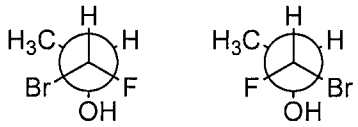


Enantiomer:

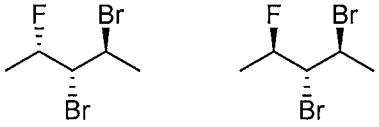


Total stereoisomers = $2^3 = 8$ (this molecule + its enantiomer + 6 diastereomers)

2) For each of the following pairs of molecules, are they identical, enantiomers, diastereomers, constitutional isomers, or unrelated? (12 pts)

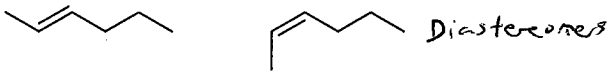
a. 

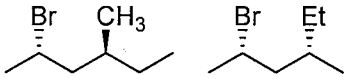
Diastereomers

d. 

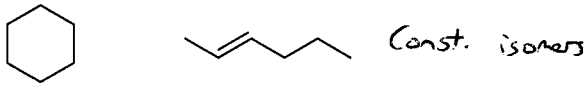
Diastereomers

b. 
Const. isomers

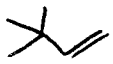
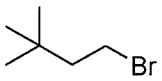
e. 
Diastereomers

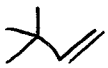
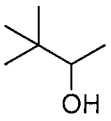
c. 

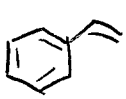
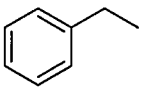
Identical

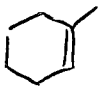
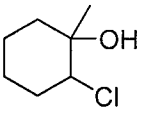
f. 
Const. isomers

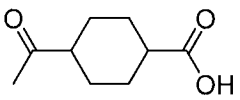
3) Starting from any hydrocarbon with the same number of carbon atoms as the product, and using any reactions that have been covered so far in class, show how you would create the products shown as the only major product of the reaction. Write your hydrocarbon starting material before the arrow, and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

a.  $\xrightarrow{HBr,\ ROOR}$ 

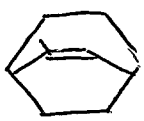
b.  $\xrightarrow[2)\ NaBH_4,\ NaOH]{1)\ Hg(OAc)_2,\ H_2O,\ THF}$ 

c.  $\xrightarrow{H_2,\ Pd/C}$ 

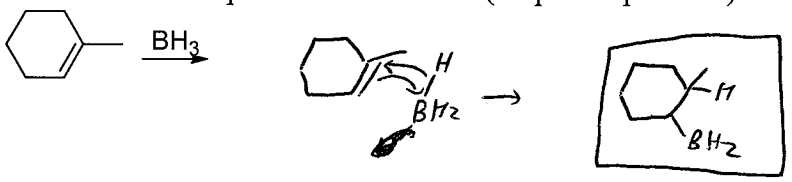
d.  $\xrightarrow{Cl_2,\ H_2O}$ 

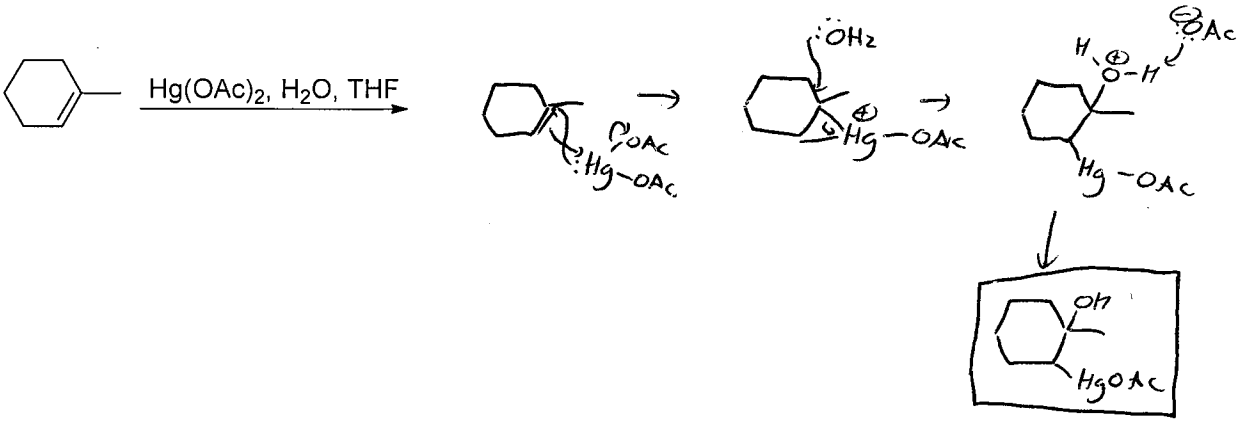
e.  $\xrightarrow[2)\ H_2O,\ H_2O_2]{1)\ O_3}$ 

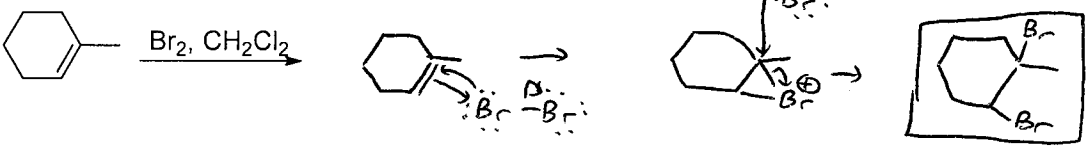
or



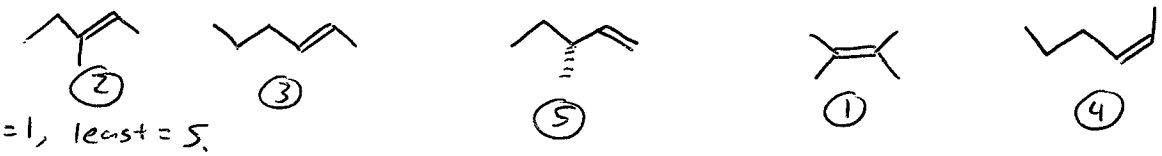
4) Show a mechanism for each reaction, and draw a box around the major product. Assume each molecule of reagent reacts with only one molecule of starting material. For radical reactions, clearly differentiate the initiation, propagation, and termination steps; you only need to show 2 examples of termination. (18 pts - 6 pts each)

a. 

b. 

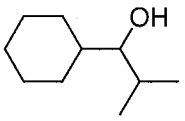
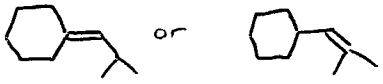
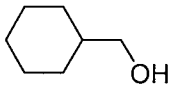
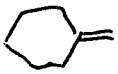
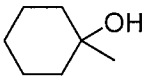
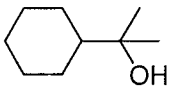
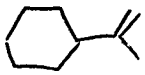
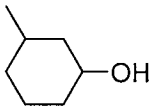
c. 

5) Put the following alkenes in order of stability, from most stable to least stable. (10 pts)
(E)-3-methyl-2-pentene, (E)-2-hexene, (R)-3-methyl-1-pentene, 2,3-dimethyl-2-butene, (Z)-2-hexene



Most stable = 1, least = 5.

6) Several alcohol compounds are shown below. Which ones can be produced as the only major product of hydroboration-oxidation? Which ones can be produced as the only major product of acid-catalyzed hydration? Draw a single alkene starting material for each reaction that would work. If there is no good starting material to create that product from that reaction, leave the box empty. (25 pts)

Alcohol	Draw an alkene starting material (if any) for hydroboration-oxidation	Draw an alkene starting material (if any) for acid-cat. hydration
		—
		—
	—	
	—	
	—	—

7) Extra credit! Propose a reasonable mechanism for the reaction shown below. This is an example of an iodolactonization. (10 pts e.c.)