CHEM 3331 (Richardson) Final Exam – May 8, 2019

Your Name: _____

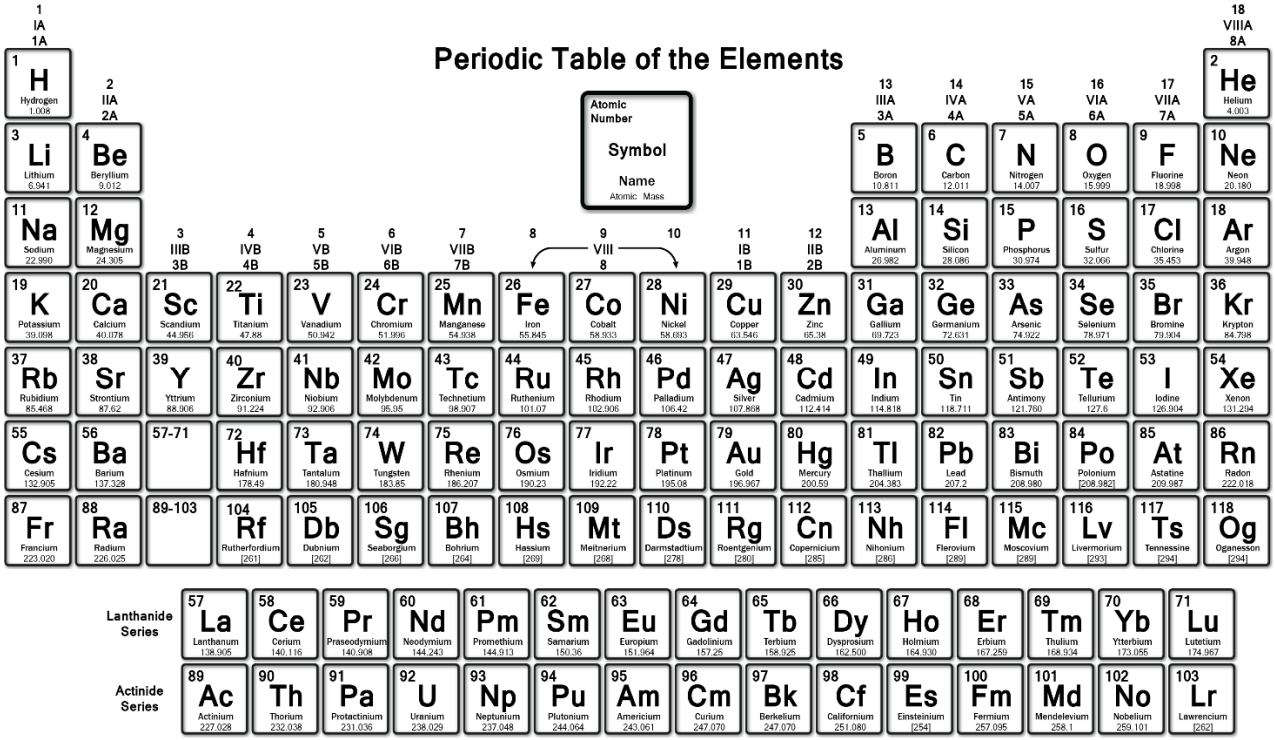
Student ID: _____

Recitation (check one)

O 130 (Wed 8:00 w/ Olivia)
O 134 (Wed 12:00 w/ Olivia)
O 136 (Wed 2:00 w/ Lacey)
O 138 (Wed 4:00 w/ Lacey)
O 141 (Thu 9:00 w/ Chance)
O 143 (Thu 11:00 w/ Chance)
O 145 (Thu 1:00 w/ Lacey)
O 147 (Thu 3:00 w/ Will)
O 149 (Thu 5:00 w/ Will)
O 235 (Wed 1:00 w/ Lauren)
O 237 (Wed 3:00 w/ Lauren)
O 239 (Wed 5:00 w/ Zepeng)
O 240 (Thu 8:00 w/ Zhenhao)
O 242 (Thu 10:00 w/ Lauren)
O 244 (Thu 12:00 w/ Lauren)
O 246 (Thu 2:00 w/ Brianna)
O 248 (Thu 4:00 w/ Brianna)

Question	Score	Out of
1		20
2		30
3		45
4		45
5		40
6		20
7		10 e.c.
Total		200

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 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.

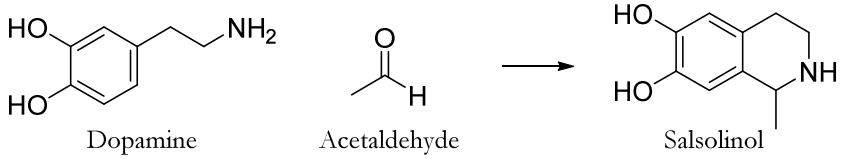


pKa Values

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

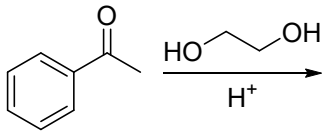
1) D-Xylose is an aldopentose that was first isolated from wood. It can be hydrogenated to form xylitol, a sweetener used in "sugar-free" gum and candy. In an attempt to figure out the structure of D-xylose, you oxidize it with dilute nitric acid (converting both end groups to carboxylic acids) and find it to be optically inactive. You also perform a Kiliani-Fischer synthesis (extending the upper end of the chain by one carbon and creating a new stereocenter) on D-xylose and get two different hexoses, both of which are optically active. Draw the structure of D-Xylose. (20 pts)

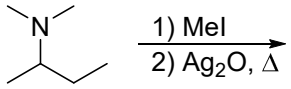
2) Salsolinol, shown below, is formed in the brain when acetaldehyde reacts with dopamine. Draw a reasonable mechanism for this reaction. Assume acids and bases are present as needed. (This is an example of the Pictet–Spengler reaction.) (30 pts)

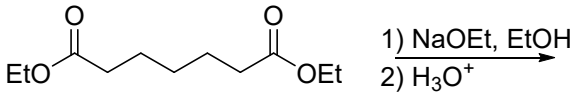


Dopamine Acetaldehyde Salsolinol

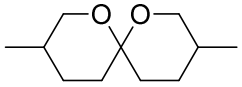
3) Show the mechanism and product for these reactions. You do not need to show resonance forms for intermediates. (45 pts)

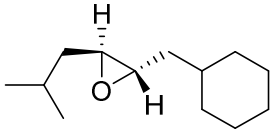
a. 

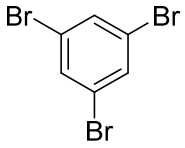
b. 

c. 

4) Find a way to synthesize the desired product from any reagents containing at most six carbon atoms, or triphenylphosphine, or any transition metal catalyst. (45 pts)

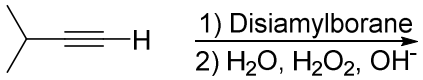
a. 

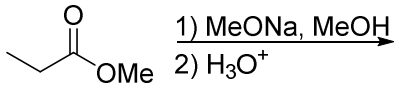
b. 

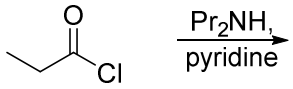
c. 

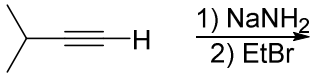
from benzene

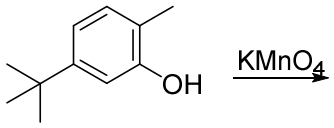
5) Predict the major product of the following reactions. If no reaction occurs, then write NR. Do not show stereochemistry. If an aldol-type reaction occurs, assume it only occurs once and does not involve subsequent additions. (40 pts; 4 pts each)

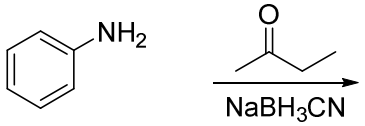
a. 

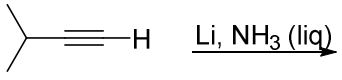
b. 

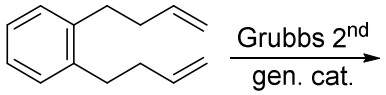
c. 

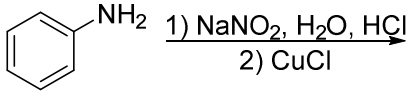
d. 

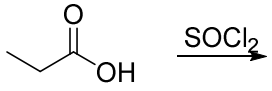
e. 

f. 

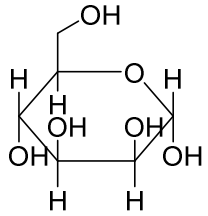
g. 

h. 

i 

j. 

6) The pyranose form of a carbohydrate is shown below. (20 pts)



Draw the following structures for this compound. (5 pts each)

a. Fischer projection for acyclic form

b. Haworth projection for α-furanose form (you don't need to show stereochemistry on parts that are outside the ring)

c. Which terms describe this compound? **L**, **D**, aldose, ketose, pentose, hexose. (6 pts)

d. How many enantiomers does the acyclic form of this compound have? (2 pts)

e. How many diastereomers does the acyclic form of this compound have? (2 pts)

7) Extra credit! Most alkyl bromides are water-insoluble liquids. But when 7-bromo-1,3,5-cycloheptatriene was first isolated, its high melting point of 203 °C and its water solubility led its discoverers to comment that it behaves more like a salt. Explain the salt-like behavior of this compound in under thirty words. (10 points e.c.)