

CHEM 3331 (Richardson) Midterm Exam 1 – Jul. 18, 2023

Your Name: _____

Student ID: _____

Recitation (fill in one circle):

O 211 (Charlie Lu)

O 212 (Kajal)

O 213 (Mia Muse)

O 214 (Kyle Fisch)

Question	Score	Out of
1		20
2		15
3		20
4		15
5		30
6		10 e.c.
Total		100

This is a closed-book exam, except for one double-sided sheet of 8.5 x 11" paper. The use of 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.

Periodic Table of the Elements

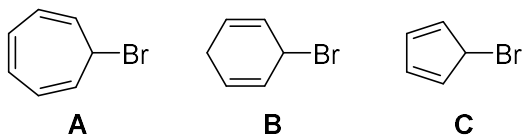
Atomic Number
Symbol
Name
Atomic Mass

1 1A 1A H Hydrogen 1.008	2 2A 2A He Helium 4.003																																																																																						
3 Li Lithium 6.941	4 Be Beryllium 9.012																																																																																						
11 Na Sodium 22.990	12 Mg Magnesium 24.305																																																																																						
19 K Potassium 39.098	20 Ca Calcium 40.078																																																																																						
37 Rb Rubidium 85.468	38 Sr Strontium 87.62																																																																																						
55 Cs Cesium 132.905	56 Ba Barium 137.328																																																																																						
87 Fr Francium 223.020	88 Ra Radium 226.025																																																																																						
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pKa Values

HI	-10	CH ₃ COOH	4.7	ArOH	10	HC≡CH	26
HBr	-8	HN ₃	4.7	RSH	10-12	H ₂	35
HCl	-6	H ₂ S	7.0	H ₂ O	15.7	NH ₃	36
H ₃ O ⁺	-1.7	NH ₄ ⁺	9.3	ROH	16-18	H ₂ C=CH ₂	45
HF	3.2	HCN	9.4	O=C-CH	9-25	CH ₄	60

1) The three molecules shown below were reacted with water to create an alcohol. (20 pts total)



a. The same mechanism is occurring in all three reactions. Circle which one it is. (5 pts)

S_N2

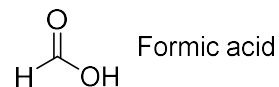
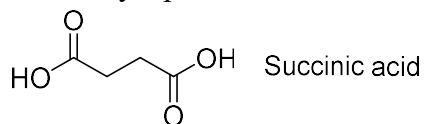
S_N1

E2

E1

b. Which molecule is fastest at this reaction, which is slowest, and why? (15 points)

2) Compound A (C_6H_6) undergoes catalytic hydrogenation with Lindlar catalyst to give a compound B, which in turn undergoes ozonolysis followed by workup with aqueous H_2O_2 to produce succinic acid and two equivalents of formic acid, shown below. Hydrogenation of A with palladium catalyst produces n-hexane. Propose a structure for compound A. (15 pts)

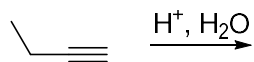


3) When 2,3-dimethyl-1,3-cyclohexadiene reacts with one equivalent of water in the presence of an acid catalyst, two products are formed. (20 pts total)

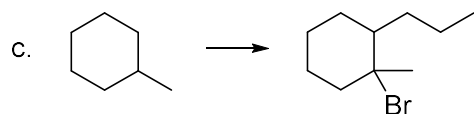
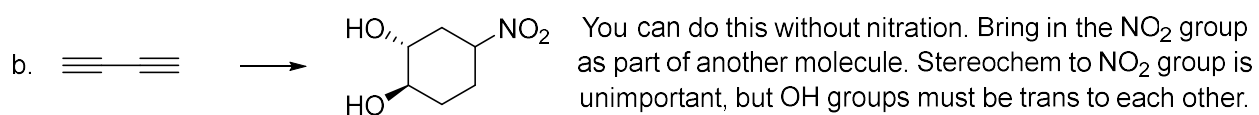
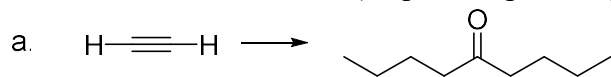
a. Show the mechanism that forms the kinetic product. (10 pts)

b. Show the mechanism that forms the thermodynamic product. (10 pts)

4) Write out the mechanism and final product for the reaction below. (15 pts)



- 5) Find a way to synthesize the desired product from the given starting material plus any other organic molecules needed. If more than one step is necessary, show the product of each step. Do not show mechanisms. (30 pts - 10 pts each)



- 6) Extra credit! This recently-published synthesis of clivonine (isolated from plants in the Amaryllis family) used a Diels-Alder reaction to create a bicyclic structure. What was the structure of the diene? (10 pts extra credit)

