CHEM 3331 (Richardson) Midterm Exam 1 – Sep. 26, 2023

Your Name: ____

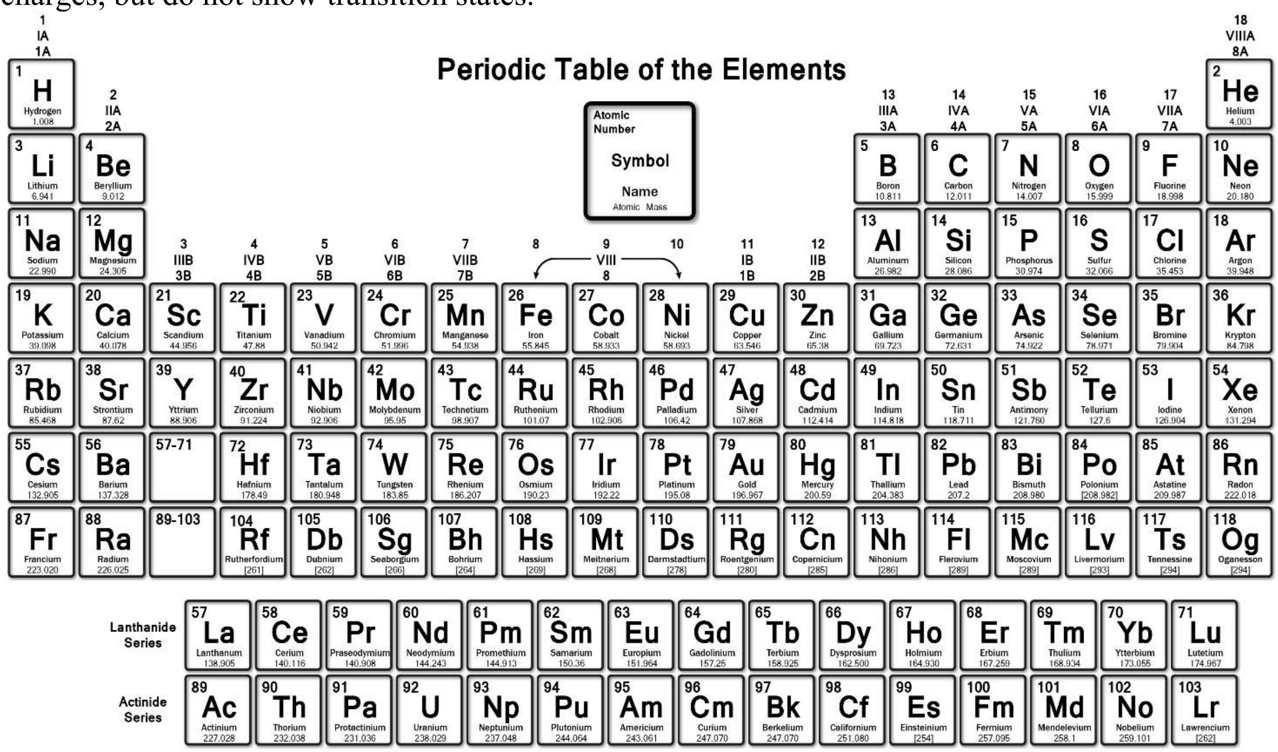
Student ID: ____

Recitation TA (fill in one circle):

O 134 (Alec Kolodziejczyk)   O 142 (Kajal)
O 135 (Alec Kolodziejczyk)   O 143 (Kajal)
O 136 (Lukas Gardner)   O 144 (James Greenwood)
O 137 (Lukas Gardner)   O 147 (Lukas Gardner)
O 141 (Kyle Fisch)

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

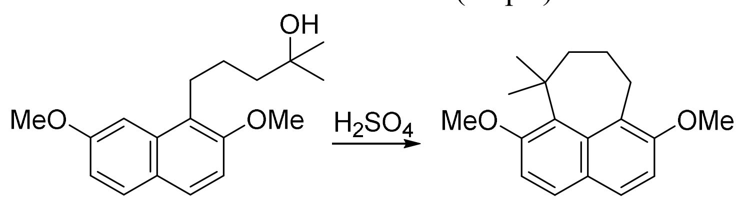
This is a closed-book exam, except for one double-sided sheet of 8.5 x 11" paper. The use of calculators or cell phones will not be allowed during the exam. You may use models sets brought in a clear bag. Use the backs of the pages for scratch work. If your final answer is not clearly specified, you will lose points. For mechanisms, show all intermediates including correct formal charges, but do not show transition states.



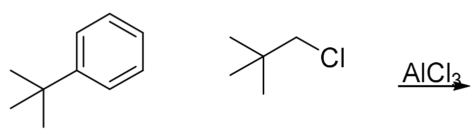
pKa Values

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

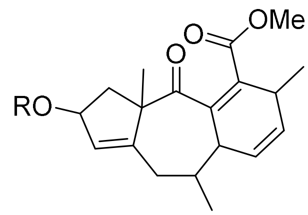
1) The reaction shown below was part of a synthesis to create microstegiol, a compound found in salvia plants. Show a mechanism for this reaction. (20 pts)



2) Show the mechanism and product for this reaction, assuming only a single addition occurs. (15 pts)



3) The molecule below is an intermediate in the synthesis of caribenol A, a molecule with promising anticancer properties. It was recently synthesized via a Diels-Alder reaction. (15 pts total)

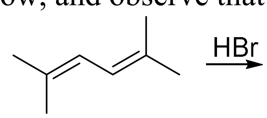


a. Draw a star inside the ring which was formed during the Diels-Alder reaction. (1 pts)

b. Draw the two disconnect lines (∘—∘) across the bonds that were formed during this reaction. (4 pts)

c. Draw the precursor molecule that reacted to form this product. (10 pts)

4) You perform the reaction shown below, and observe that two products are formed. (20 pts)



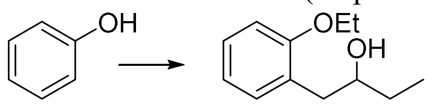
a. Show a mechanism for the formation of the 1,2-addition product. (8 pts)

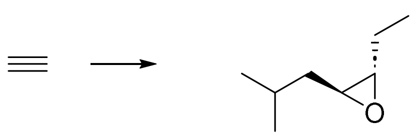
b. Show a mechanism for the formation of the 1,4-addition product. (8 pts)

c. Which of these gives the more stable final product? (2 pts)

d. Which of these proceeds through the most stable carbocation? (2 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 - 15 pts each)

a. 

b. 

6) Extra credit! The molecule shown below is an astonishingly strong acid for an organic compound; it has a pKa of -2! This is because of two factors that each contribute to the stability of its conjugate base. Explain both of these factors in under thirty words total. (10 pts extra credit)