CHEM 3311, Professor Zhang, Spring 2010
First hour exam, Feb 11, 2010

Printed Name:_____ Student ID:_____

Scores:

1)

2)

3)

4)

5)

6)

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This is a closed-book exam. The use of notes, models, calculators, scratch paper will not be allowed during the exam. Please put all your answers on the test. Use the backs of the pages for scratch.

Partial Periodic Table

1A	2A	3A	4A	5A	6A	7A	8A
1 H							2 He
3 Li	4 Be	5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg	13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
						35 Br	
						53 I	

1) (16 pts) For each of the following molecules:
   1. Draw a valid valence bond structure, showing all formal charges and unshared electrons. (12pts)
   2. Indicate which type of hybridization of each **second row** atom (with atomic number 3-10) in your structures.(4pts)

a. $(CH_3)^{\ominus}$

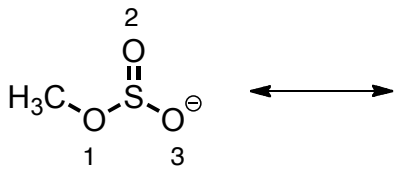
b. $(CH_3)^{\oplus}$

c. $(BCl_4)^{\ominus}$

d. $(CH_3NH_3)^{\oplus}$

2) (12pts) Resonance structure

A. Draw the most important resonance structure for the molecule shown below. Show all arrows required to go from one resonance structure to the other (**both** structures should have arrows) (6pts).



B. For the molecule shown in 2A above, how much negative charge resides on each oxygen (O1, O2 and O3, give your answer in percentage negative charge on each oxygen)? (6pts)

charge on O1_____% charge on O2_____% charge on O3_____%

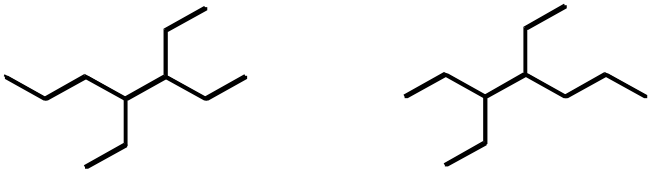
3) (14pts) Isomers

1. Indicate the relationship of each of the following pairs of structures, using one of the following pairwise descriptions: Constitutional Isomers, Stereoisomers, or Homomers (same molecule). (8pts)

a)

b)

c)

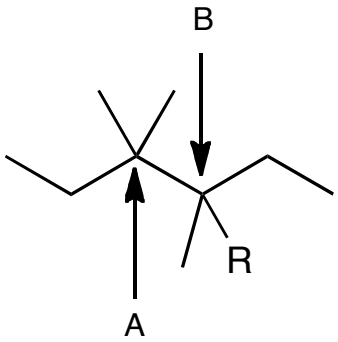


d)

2. For the structures 3a-3c, indicate which of the pair of structures represents the more stable compound by circling the structures. If the two structures have the same stability, label them "same". (6pts)

4) (25pts) Newmann Projection

a. If R=CH_3, give the IUPAC name for the following molecule. (3pts)



b. If R=CD_3 (D is a symbol for deuterium, which is a stable isotope of hydrogen with similar atomic size), draw Newmann Projections of the three staggered conformations **AND** three eclipsed conformations of this molecule, sighting down the two carbons labeled as A and B (carbon A in front !) (18pts)

Staggered

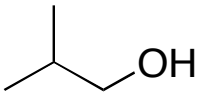
Eclipsed

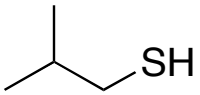
c. For the conformations in part 4b, indicate both the **least** and the **most** stable conformation. (4pts)

5) (16pts) Acid-Base

1. For each of the following pairs of molecules, circle the stronger Brønsted **ACID**. (6pts)

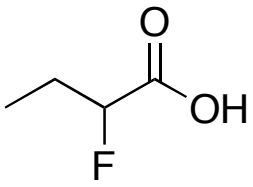
a.

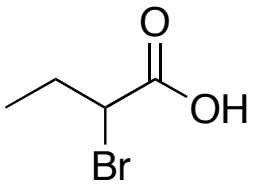




b. $H_2C{=}CH_2$ $HC{\equiv}CH$

c.

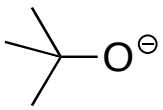


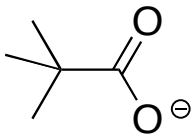


2. For each of the following pairs of molecules, circle the stronger Brønsted **BASE**.(4pts)

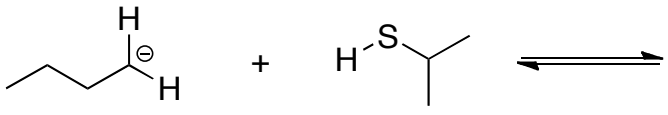
a) $^{\ominus}NH_2$ $^{\ominus}OH$

b)





3. For the following reaction: 1) use curved-arrow to show the electron flow; 2) draw the product structures; 3) indicate whether the equilibrium constant is less than 1 or greater than 1. (6pts)

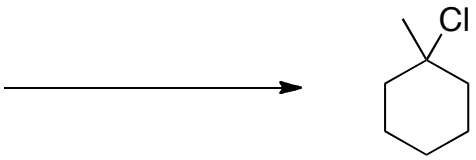


Equilibrium constant_____1 (>, < or =)

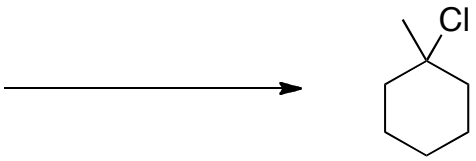
6) (17pts) Addition reaction

1. The 1-chloro-1-methylcyclohexane shown below can be synthesized from two different alkenes. Provide two syntheses below. Include the reagents required to accomplish your synthesis. (8pts)

a.

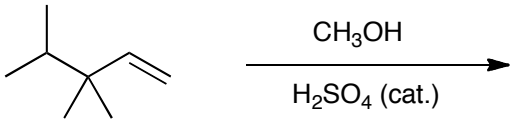


b.

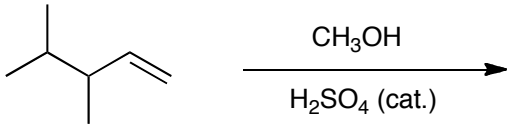


2. Give the **single major** organic product for each of the following reactions. (9pts)

a.



b.



c.