Organic Chemistry 1 Exam #1 12 Apr 2014 Student # Name

Total 100 points. Write your answers in the space provided. If you need more space, write on the back.

1. For the following compounds, answer the questions.

(A) CH_2Cl_2 (B) NH_3 (C) NF_3 (D) CH_3COOH (E) CH_2=CHCl

(a) [5 x 2 points] Draw the perspective formulas of each compound showing 3-D shape of the molecule and indicate the direction of the dipole moment of the molecule. Use heavy (solid) and dashed (hatched) wedges if necessary.

(A) (B) (C)

(D) (E)

(b) [3 points] The dipole moment of C (0.24D) is much smaller than that of B (1.47D). Explain.

(c) [3 points] Which of B or C is a weaker base? Explain.

2. [3 x 3 points] **Tell whether the statement is correct or false, and explain your answer.**

(a) Hund's rule dictates that, when degenerate orbitals are available, electrons first occupy them in pairs with opposite spins.

(b) While bonding molecular orbitals do not have nodal plane, anti-bonding molecular orbitals have.

(c) Hybridization states of carbon in methyl cation and methyl anion are different.

3. For C_3H_8O answer the following questions.

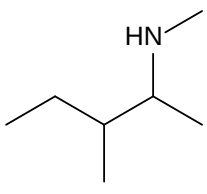
(a) [9 x 1 point] Draw the three (3) structural isomers, and name them by using both common and systematic (IUPAC) nomenclatures.

(b) [3 points] Arrange the isomers in the increasing order of boiling point. Explain your answer.

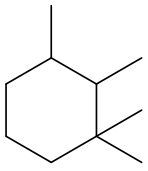
(c) [3 points] Arrange the isomers in the increasing order of solubility to water. Explain your answer.

4. [2 x 3 points] **Give the systematic name of the following compounds.**

(a)

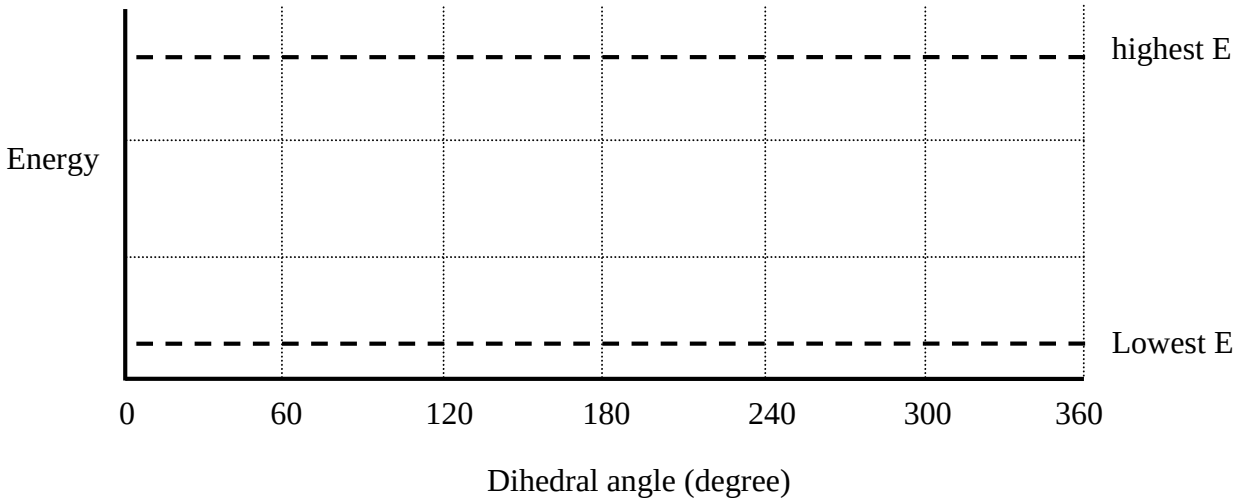


(b)

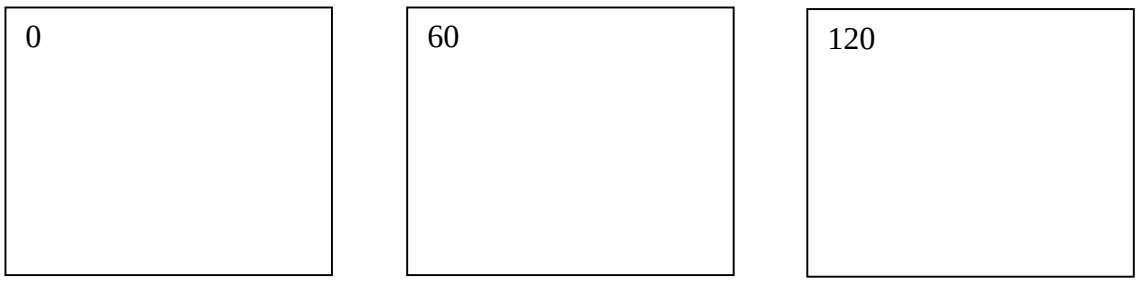


5. For 2-methylbutane answer the following questions.

(a) [6 points] Construct the energy – dihedral angle plot for the conformations about the C2-C3 bond. Start (zero degree) with the highest energy conformation, and rotate the front carbon (C2) clockwise.

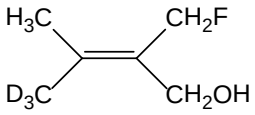


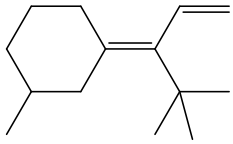
(b) [3 x 2 points] Draw the Newman projections of the conformations at 0, 60, and 120 degree.



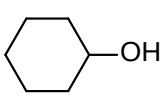
6. [6 points] **For 1-*tert*-butyl-3-methylcyclohexane, is *cis*- or *trans*-isomer more stable? Explain your answer.**

7. [2 x 3 points] **Assign the following configuration as *Z* or *E*.**

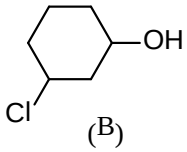
(a) 

(b) 

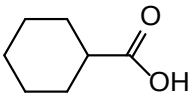
8. [6 points] **Arrange the following compounds in the order of increasing acidity, and explain your answer.**



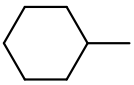
(A)

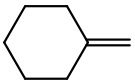


(B)

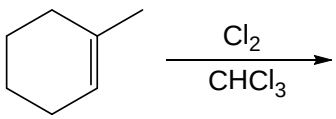


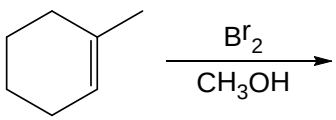
(C)

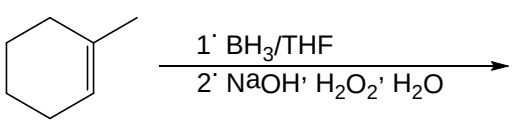

(D)

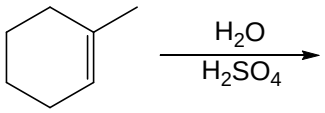

(E)

9. [4 x 3 points] **Show the product(s) of the following reactions.**

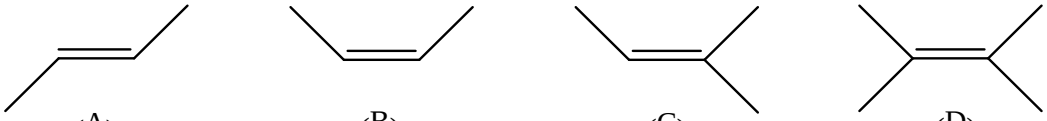
(a) 

(b) 

(c) 

(d) 

10. [4 x 3 points] **The following alkenes are subjected to acid-catalyzed hydration. Answer the questions.**



(a) Arrange A, B, C, and D in the increasing order of stability. Briefly explain your answer.

(b) The reaction of B is faster than that of A. Explain why.

(c) The reaction of C is faster than that of A. Explain why.

(d) The reaction of D is faster than that of C. Explain why.