Exam 2 Spring 2014

Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Room \_\_\_\_\_\_\_\_\_\_\_\_

Student ID\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Seat Number\_\_\_\_\_\_\_\_

**Circle One 11:15 AM Class 12:20 PM Class**

The exam consists of 10 questions on a total of 12 pages, including periodic table.

1. \_\_\_\_\_/10
2. \_\_\_\_\_/10
3. \_\_\_\_\_/10
4. \_\_\_\_\_/10
5. \_\_\_\_\_/10
6. \_\_\_\_\_/10
7. \_\_\_\_\_/10
8. \_\_\_\_\_/10
9. \_\_\_\_\_/8
10. \_\_\_\_\_/12

**Regrading: All requests for regrades must be submitted in writing within 48 hours of the return of the exam. You must explicitly state what has been misgraded and why it is an error. The entire exam will be regraded, which could result in points being added or deducted overall.**

1. (10 points) Draw a mechanism for each of the following reactions.

a) (4 points)



b) (3 points)



c) (3 points)



2. (10 points)

a) (6 points) Draw ***all*** of the stereoisomers of the following compound.



b) (4 points) Using Newman projections draw the ***highest energy conformation*** of the compound illustrated below. Only consider conformations that rotate the indicated bond.



3. (10 points)

a) (6 poitns) Please identify if each of the following compounds are “chiral”, “achiral” or “achiral and meso”. ***If the compound contains chirality centers, please indicate R or S for each center.***



b) (4 points) Determine the relationship between the followings pairs of compounds. Write “same,” “constitutional isomers,” “enantiomers,” or “diastereomers.”



4. (10 points)

a) (5 points) The difference between the axial and equatorial conformations of compound **A** is -5.4 kJ/mol. Why is this different than the free energy difference between axial and equatorial conformations of methylcyclohexane, which is -7.6 kJ/mol? Please support your answer with figures and text.



b) (5 points) When compound **A** is dissolved in aqueous HCl, the difference between the axial and equatorial conformations of compound **A** is now very similar to that of methylcyclohexane, why? Please support your answer with figures and text.

5. (10 points)

a) (3 points) Draw the ***lowest*** energy conformation of 2-methylbutane. Use a Newman projection to illustrate your answer.

b) (3 points) Draw the ***highest*** energy conformation of 2-methylbutane. Use a Newman projection to illustrate your answer.

c) (4 points) Using the values provided at the end of the exam, what is the energy difference between these two conformations.

6. (10 points) Consider the following ***SN1 reaction*** and answer the following questions.



a) (2 points) What is the rate equation of this reaction?

b) (2 points) Would the reaction occur at a faster rate if the concentration of NaBr was doubled? Provide a brief explanation.

b) (6 points) Draw a reaction coordinate energy diagram for the above process. (You may assume the reaction is exergonic) ***Clearly identify all intermediates and transition states.***

7. (10 points)

For the following ***substitution*** reactions, fill in the blank. (2 points each)

a)



b)



c)



d)



e)



8. (10 points)

a) (6 points) Predict the major product(s) in each elimination reaction.



b) (4 points) Under each potential product of this E2 elimination, write “major product,” “minor product,” or “not formed.”



9. (8 points) Draw the products and provide mechanisms for these reactions.



10. (12 points) For each of the reactions below, indicate the major mechanism by which it proceeds as either E1, E2, SN1, SN2, or a mixture of these mechanisms. Then draw the major product of each reaction. (Partial credit will be given for a major product consistent with the mechanism selected, even if the selected mechanism is incorrect. If the major product given is inconsistent with the selected mechanism, then it is wrong.)





Conformational Energies:

H/H eclipsing 4 kJ/mol

H/CH3 eclipsing 6 kJ/mol

CH3/CH3 eclipsing 11 kJ/mol

CH3/CH3 gauche 3.8 kJ/mol

Scratch work: