Exam 1 Summer 2017

Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Seat Number\_\_\_\_\_\_\_\_

Student ID\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The exam consists of 10 questions worth 102 points on a total of 6 pages. It will be scored out of 100 points.

1. \_\_\_\_\_/12
2. \_\_\_\_\_/10
3. \_\_\_\_\_/8
4. \_\_\_\_\_/10
5. \_\_\_\_\_/12
6. \_\_\_\_\_/16
7. \_\_\_\_\_/8
8. \_\_\_\_\_/8
9. \_\_\_\_\_/10
10. \_\_\_\_\_/8

Total:

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. (12pts) Draw all significant resonance structures for the following compounds, and then draw a resonance hybrid, indicating all atoms bearing partial positive or negative charges.



2. (10pts) Give the name of the functional group in each molecule. Indicate the pKa of each proton in bold, and indicate which of the four acids is the strongest and which is the weakest.



3. (8pts) In the molecule below, mark the least stable lone pair, and explain how you came to this conclusion. Then draw the conjugate acid and conjugate base of the compound.



4. (10pts) Draw a Newman projection for the most and least stable conformations of 2,2-dibromo-3,3-dichlorobutane around the C2-C3 bond. Calculate the difference in energy between these conformations using these data: Cl/Cl eclipse strain: 0.9 kcal/mol; Br/Br eclipse strain: 1.1 kcal/mol; Cl/Br eclipse strain: 1.0 kcal/mol; methyl/methyl eclipse strain: 3.2 kcal/mol; methyl/Cl eclipse strain: 1.4 kcal/mol; methyl/Br eclipse strain: 1.5 kcal/mol; methyl/methyl gauche strain: 1.0 kcal/mol; CH3/Br gauche strain: 0.5 kcal/mol; CH3/Cl gauche strain: 0.4 kcal/mol; Cl/Br gauche strain: 0.3 kcal/mol; Cl/Cl gauche strain: 0.2 kcal/mol.

5. (12pts) Indicate whether or not each of the following compounds would be completely deprotonated by NaOH, and explain how you came to your answer using pKa values or base stability principles.



6. (16 pts) A. Provide a mechanism for this reaction, including initiation and propagation steps.



B. Calculate the change in enthalpy for both propagation steps. (Show all calculations.) Draw an energy diagram, to scale, for the propagation steps of this reaction. What is the overall change in enthalpy for this reaction?



7. (8pts) Which of the following anions would you expect to form preferentially from this starting material? Draw a simplified orbital overlap picture of each anion as part of your explanation.



8. (8pts) Give a systematic names for both of these molecules:



9. (10pts) Predict the major product(s) of each of these radical monohalogenation reactions or write “no reaction.” In each case, is the reaction synthetically useful or not?



10 (8pts) Draw transition states for both of these reactions, assuming both are endothermic. Describe each transition state as either “early” or “late.”



B. Use the transition state structures you drew and the Hammond Postulate to explain the high level of selectivity observed in radical bromination. DO NOT write outside the box with your answer!



