Exam 2
Chemistry 52
July 28, 2011

Do not open or begin this exam until instructed. This exam consists of 7 pages plus the cover page. Before starting the exam, check to make sure that you have all of the pages. The exam has a total of 125 points and includes 10 questions. Only legible answers written on the exam will be considered for grading. All pertinent information needed for the exam is given. Notes, textbooks, and electronic communication devices are not permitted. This exam is administered under the Dartmouth College Honor Principle. You have 2 hours to complete the exam.

Use your time wisely.

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<thead>
<tr>
<th>Page Number</th>
<th>Value</th>
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</table>
1. (9 points, 3 each) Provide an IUPAC accepted name for each of the following compounds.

\[ \text{ } \]

\[ \text{ } \]

\[ \text{ } \]

2. (12 points, 2 each) Match the given structures to the appropriate functional group name by writing the matching letter in the box under the structure. (There are extra names.)

\[ \text{ } \]

\[ \text{ } \]

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\[ \text{ } \]

A. Acetal  
B. Amide  
C. Amine  
D. Cyanohydrin  
E. Enamine  
F. Hemiacetal  
G. Hydrazone  
H. Imide  
I. Imine  
J. Lactam  
K. Lactone  
L. Nitrile  
M. Oxime  
N. Thioester  
O. Ylide

3. Dexon™ is a polyester that is spun into fibers and used for surgical stitches that dissolve over time, thus eliminating the need for a follow-up procedure to remove the stitches. The ester moieties are slowly hydrolyzed by enzymes present in the body. a) (4 points) Provide the product of the hydrolysis of the polymer. b) (2 points) Provide an IUPAC accepted name for the hydrolysis product.

\[ \text{ } \]

Dexon™
4. (6 points, 3 per method) The following transformation can be accomplished by (at least) two methods. Provide the reagents necessary to accomplish the transformation by two methods that proceed through a different intermediate compound.

**Method 1**

\[
\text{Cyclohexanecarboxylic acid} \xrightarrow{} \text{Cyclohexanone}
\]

**Method 2**

\[
\text{Cyclohexanecarboxylic acid} \xrightarrow{} \text{Cyclohexanone}
\]

5. (9 points, 3 each) For each set of compounds, rank from least acidic to most acidic. Place your final answer in the box.

**a.**

\[
\begin{array}{ccc}
\text{A} & \text{B} & \text{C} \\
\text{Acid} & \text{Acid} & \text{Acid} \\
\text{least} & \text{most} & \text{most}
\end{array}
\]

**b.**

\[
\begin{array}{ccc}
\text{A} & \text{B} & \text{C} \\
\text{Acid} & \text{Acid} & \text{Acid} \\
\text{least} & \text{most} & \text{most}
\end{array}
\]

**c.**

\[
\begin{array}{ccc}
\text{A} & \text{B} & \text{C} \\
\text{Acid} & \text{Acid} & \text{Acid} \\
\text{least} & \text{most} & \text{most}
\end{array}
\]
6. (28 points, 4 each) Provide the organic products of the following reactions.

\[
\text{CN} + \text{MgBr} \quad 2) \quad \text{H}_3\text{O}^+
\]

\[
\text{O} + \text{MgBr} \quad 2) \quad \text{H}_3\text{O}^+
\]

\[
\text{O} + \text{HO-\text{OH}} \quad \text{TsOH, cat.} \quad \text{benzene} \quad \Delta
\]

\[
\text{O} + \text{NaCN} \quad \text{NaOH, H}_2\text{O, }\Delta \quad \text{H}_3\text{O}^+
\]

\[
\text{Br} + \text{KCN} \quad 1) \quad \text{H}_3\text{O}^+
\]

\[
\text{C} + \text{H}_2\text{NNH}_2 \quad \text{H}^+ \text{cat.} \quad \Delta
\]

\[
\text{C} + \text{POCl}_3 \quad \Delta
\]
7. (10 points) Provide a complete electron pushing mechanism for the following reaction using only the reagents listed. Be sure to include any by-products as they are formed and show arrows for every bond change. Do not combine steps!!
8. (10 points) Provide the products for the following reaction and a complete electron pushing mechanism that very clearly indicates where the $^{18}$O label will and will not be present. (For simplicity, you may use an asterisks throughout the mechanism to note the location of the $^{18}$O isotope, such as H$_2^*$O.)

\[
\begin{align*}
\text{H}^+ & \quad \text{C}^*\text{O} \\
\text{H}^+ & \quad ^{18}\text{OH}_2 \\
\Delta &
\end{align*}
\]
9. (25 points, 5 each) Complete the following short syntheses by providing reagents over arrows and intermediate compounds in the boxes. Most can be completed in two steps.
10. (10 points) Provide a synthesis for the following target compound. You may use any alcohols or alkyl halides of three carbons or less and any inorganic reagents you need. You must synthesize any organometallic reagents or ylides that you wish to use. (I consider triphenylphosphine to be an inorganic reagent and therefore acceptable as a starting material.)