Exam 1
Chemistry 52
July 11, 2011

Do not open or begin this exam until instructed. This exam consists of 6 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 110 points and includes 8 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.

Use your time wisely.

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1. a. (5 points) Provide an IUPAC accepted name for the following compound.

3-ethyl-2,5-dimethylcyclohexanol

b. (3 points) Provide the structure of m-ethylaniline.

2. (32 points, 4 each) Provide the organic products of the following reaction.

\[
\begin{align*}
\text{O} & \quad + \quad 1 \text{ eq. HBr} \quad \rightarrow \quad \text{OH} \\
\text{CH}_3\text{SH} & \quad \overset{1) \text{NaOH}}{\longrightarrow} \quad \text{CH}_3\text{SCH}_2\text{OH} \\
\text{CH}_3\text{CONH} & \quad \overset{\text{Br}_2}{\longrightarrow} \quad \text{BrCH}_2\text{CONHCH}_3 \\
\text{CO}_2\text{N} & \quad \overset{1) \Delta}{\longrightarrow} \quad \text{CO}_2\text{NCH}_2\text{CH}_2\text{CH}_2\text{CH}_3 \\
\end{align*}
\]
3. (16 points, 4 each) The following reactions do not yield the indicated product. Briefly (in one sentence) explain why not and indicate what would be formed instead.

Organometallic reagents are strong bases and alcohols are acidic.

NaBD₄ is a source of D⁻ which will attack the carbonyl carbon. (O-H comes from the solvent.)
$\text{NH}_2$

$\text{CH}_3\text{CH}_2\text{Cl}$

$\text{AlCl}_3$

$\text{NH}_2$

$\text{no reaction or}$

$\text{NH}_2$ $\text{AlCl}_3$

$N$ acts as a Lewis base and consumes all of the $\text{AlCl}_3$ catalyst, preventing electrophilic aromatic substitution from occurring.

$\text{CH}_2\text{CH}_2\text{O}$

1) $\text{LiAlH}_4$

2) $\text{H}_3\text{O}^+$

$\text{OH}$

The product shown is still at a high oxidation level and will be reduced further.

4. (12 points, 4 each) Provide the missing reagents to carry out the following reactions. You do not need to synthesize the reagents.

$\text{C}_5\text{H}_8$ $+ \text{HO}_2$ $\rightarrow$

1) $\text{Hg}^{2+}\text{CF}_3_2$

2) $\text{NaBH}_4$

or $\text{C}_5\text{H}_8\text{OH}$ $+ \equiv$

4. (12 points, 4 each) Provide the missing reagents to carry out the following reactions. You do not need to synthesize the reagents.

$\text{C}_5\text{H}_8\text{O}_2\text{C}_3\text{O}_2\text{Ph}$ $+ \text{CH}_3\text{MgBr}$ (excess) $\rightarrow$

2) $\text{H}_3\text{O}^+$
5. (10 points) Provide a complete electron pushing mechanism for the following reaction. Be sure to include any by-products as they are formed and show arrows for every bond change. Do not combine steps!!
6. (16 points, 8 each) Provide a synthesis of each of the target compounds from the given starting material. You may use any reagents you need. Clearly separate the reagents used for each step of these multi-step syntheses. You may use a retrosynthetic analysis if you wish, but be sure to write your final answer in the forward direction.
7. (6 points) Provide a synthesis for the following compound. You may use benzene, any inorganic reagents, and organic reagents containing three carbons or less. You must synthesize any organometallic reagents you wish to use. As always, write your final synthesis in the forward direction.

![Chemical structures and reactions]

8. (10 points) Provide a synthesis for the following compound. You may use any inorganic reagents and organic reagents containing three carbons or less. You must synthesize any organometallic reagents you wish to use.

![Chemical structures and reactions]

(4-methyl-3-hexanol)