CEM 852 Exam-1  
February 21, 2009

This exam consists of 5 pages. Please make certain that your exam has all of the necessary pages. Total points possible for this exam are 100. In answering your questions, please write legibly and draw all structures clearly. Write all your answers in the exam booklets. Good luck.

I. What is the difference between a stereoselective and a stereospecific reaction. (5 pts)

II. Arrange compounds 1-5 according to their base strength. (5 pts).

Strongest Base > > > > Weakest Base

III. Provide the name associated with each of the name reactions shown below. (5 pts).

1. 

2. 

3. 

4.
5. Name the catalyst

![Catalyst Diagram]

IV. Provide the product or products of the reactions outlined below. Show all intermediate compounds and be sure to indicate the product’s relative or absolute stereochemistry. For reactions where multiple products are possible, be sure to indicate the major and minor species. (30 pts)

1. 

![Reaction 1 Diagram]

2. 

![Reaction 2 Diagram]

3. 

![Reaction 3 Diagram]

4. 

![Reaction 4 Diagram]

5. 

![Reaction 5 Diagram]

6. 

![Reaction 6 Diagram]
7. \[
\begin{array}{c}
\text{Me} \\
\text{CO}_2\text{H} \\
\text{O}
\end{array}
\xrightarrow{(1.0\text{ eq})\text{ m-CPBA}} \begin{array}{c}
\text{CH}_2\text{Cl}_2
\end{array}
\]

8. \[
\begin{array}{c}
\text{Ph}^+ \text{O} \\
\text{O} \\
\text{OH} \\
\text{OAc}
\end{array}
\xrightarrow{1.\text{ PDC}} \begin{array}{c}
\text{Me}
\end{array}
\xrightarrow{2.\text{ NaBH}_4} \begin{array}{c}
\text{O} \\
\text{H} \\
\text{O}
\end{array}
\xrightarrow{3.\text{ H}^+} \begin{array}{c}
\text{C}
\end{array}
\xrightarrow{4.\text{ H}_2, \text{Pd(OH)}_2} \begin{array}{c}
\text{C}
\end{array}
\]

9. \[
\begin{array}{c}
\text{Ph}^- \text{S} \\
\text{O} \\
\text{O}
\end{array}
\xrightarrow{1.\text{ NaOAc, Ac}_2\text{O}} \begin{array}{c}
\text{Ph}
\end{array}
\xrightarrow{2.\text{ LiOH}} \begin{array}{c}
\text{C}
\end{array}
\]

10. \[
\begin{array}{c}
\text{O}
\end{array}
\xrightarrow{1.\text{ }^1\text{O}_2} \begin{array}{c}
\text{H}
\end{array}
\xrightarrow{2.\text{ Ac}_2\text{O}} \begin{array}{c}
\text{O}
\end{array}
\]

V. Provide conditions which will effect the transformations outlined below. Some of these conversions will require more than one reaction, so be sure to show all intermediate compounds. (15 pts)

1. \[
\begin{array}{c}
\text{C}
\end{array}
\xrightarrow{1.} \begin{array}{c}
\text{C}
\end{array}
\xrightarrow{2.} \begin{array}{c}
\text{C}
\end{array}
\]

2. \[
\begin{array}{c}
\text{SPh}
\end{array}
\xrightarrow{1.} \begin{array}{c}
\text{NH}_2
\end{array}
\]

3. \[
\begin{array}{c}
\text{MOMO}
\end{array}
\xrightarrow{1.} \begin{array}{c}
\text{OH}
\end{array}
\xrightarrow{2.} \begin{array}{c}
\text{C}
\end{array}
\]
VI. Provide the starting substrate for each transformation shown below. (15 pts)

1. 
   \[ A \xrightarrow{1. \text{ Hg(OAc)}_2, \text{ MeOH}} \xrightarrow{2. \text{ KBr}} \]
   \[ \text{MeO} \xrightarrow{\text{HO}_2\text{C}} \xrightarrow{\text{Et}} \text{Me} \]

2. 
   \[ B \xrightarrow{1. \text{ B}_{2}\text{H}_6; \text{CrO}_3, \text{H}_3\text{O}^+} \xrightarrow{2. \text{ LDA}; \text{PhSeCl}} \xrightarrow{3. \text{ NaIO}_4, \text{NaHCO}_3} \xrightarrow{4. \text{ t-BuOOH, NaOH}} \xrightarrow{5. \text{ BF}_3\cdot\text{Et}_2\text{O, PhH}} \]
   \[ \text{CHO} \xrightarrow{\text{Me}} \]

3. 
   \[ C \xrightarrow{1. \text{ Burgess' Reagent}} \]
   \[ \text{OH} \]
   
   \[ \xrightarrow{2. \text{ 9-BBN}} \xrightarrow{3. \text{ H}_2\text{O}_2, \text{NaOH}} \]

4. 
   \[ D \xrightarrow{1. \text{ LDA}} \xrightarrow{2. \text{ Ac}_2\text{O}} \xrightarrow{3. \text{ PhCO}_3\text{H, CHCl}_3} \xrightarrow{4. \text{ TsOH, CHCl}_3} \]
   \[ \text{AcO}_\text{Ac} \]

5. 
   \[ E \xrightarrow{1. \text{ DIBAL}} \xrightarrow{2. \text{ MnO}_2} \xrightarrow{3. \text{ MeMgBr}} \xrightarrow{4. \text{ CrO}_3} \]
VIII. Give a detailed mechanistic account of the following reaction sequence. (10 pts)

\[
\begin{align*}
1. \text{KOTBu, benzophenone, PhH, heat, 40 min} & \rightarrow \\
2. \text{K-selectride} & \rightarrow \\
3. \text{H}_2\text{O}^+ & \\
\end{align*}
\]

IX. Give a detailed mechanistic account of the following reaction sequence. (10 pts)

\[
\begin{align*}
1. \text{NBS, THF} & \rightarrow \\
2. \text{(Cy-Hex)}_2\text{BH, THF 0 °C} & \rightarrow \\
3. \text{H}_2\text{O}_2, \text{NaHCO}_3 & \\
\end{align*}
\]

X. For the reactions below, explain the relative regio- and stereochemical results, including the observed syn addition. (5 pts)

\[
\begin{align*}
\text{DCI} & \rightarrow \\
\text{CH}_3\text{NO}_2, 25 \degree \text{C} & \\
\end{align*}
\]

**Bonus Question:** This semester we used Newman projections to help understand the stereochemical consequences of reactions. Mel Newman spent the first part of his childhood in New Orleans, before moving to New York at the age of 14. Having grown up in two of the great centers of jazz music, it is perhaps no surprise that Newman would become a life long fan and ultimately a friend of Louis Armstrong. Interestingly enough it was another chemist who brought Satchmo from New Orleans to New York. This particular chemist earned his undergraduate degree from Atlanta University and then began post-graduate work at Columbia University. Times being what they were, he was not offered a graduate stipend owing to his race and thus turned to music for a living. As both a jazz big band leader and especially as an arranger, he was very successful. Who was this influential jazz great/chemist? (2 pts)

a. Fletcher Henderson  
b. Earl Hines  
c. Johnny St. Cyr  
d. Kid Ory  
e. Kid Rock