Homework set for CEM 221
Due at 9 AM Wednesday, October 18, 2006

1. Draw a structure corresponding to each of the following names (2 points each)
   a) \( E \)-4-propargyl-1,4-hexadiene
   \[
   \begin{array}{c}
   \text{CH}_2=CH-CH\equiv CH-CH=CH_2
   \end{array}
   \]
   b) 5,6-dimethyl-2-heptyne
   \[
   \begin{array}{c}
   \text{CH}_3-\text{C}≡\text{C}-\text{CH}-\text{CH}_2-\text{CH}_2-\text{CH}_3
   \end{array}
   \]
   c) \( Z \)-3-isopropoxy-3-hexene
   \[
   \begin{array}{c}
   \text{CH}_3-\text{C}≡\text{C}-\text{CH}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{O}-\text{CH}_3
   \end{array}
   \]
   d) \( Z \)-3-chloro-1-butene
   \[
   \begin{array}{c}
   \text{CH}_2=\text{CH}-\text{CH}_2-\text{CH}_2-\text{Cl}
   \end{array}
   \]
   e) \( R,R \)-1,2-dichlorocyclohexane
   \[
   \begin{array}{c}
   \text{Cl}\cdots\text{Cl}
   \end{array}
   \]

2. For each of the following products, draw a structure that could have produced it using the given reagents. (2 points each)
   a)
   \[
   \begin{array}{c}
   \text{NaNH}_2
   \end{array}
   \]
   \[
   \begin{array}{c}
   \text{C}_3\text{H}_7-\text{C}=\text{C}-\text{Na}
   \end{array}
   \]
   b)
   \[
   \begin{array}{c}
   \text{H}_2
   \end{array}
   \]
   \[
   \begin{array}{c}
   \text{C}_3\text{H}_6
   \end{array}
   \]
   c)
   \[
   \begin{array}{c}
   \text{BH}_3
   \end{array}
   \]
   \[
   \begin{array}{c}
   \text{H}_2\text{O}_2, \text{NaOH}
   \end{array}
   \]
   d)
   \[
   \begin{array}{c}
   \text{H}_3\text{C}-\text{C≡CH}
   \end{array}
   \]
   \[
   \begin{array}{c}
   \text{H}_3\text{C}-\text{C≡CNa}
   \end{array}
   \]
3. Assign a complete, correct IUPAC name (including R/S or E/Z as appropriate) to each of the following structures (2 points each)

b) ![Image of structure]

   S,S-3,5-dimethylocyclopentene

c) ![Image of structure]

   1-chloro-3-methylbutane

e) ![Image of structure]

   1R,3R,4S-3,4-epoxycyclohexanol

4. Draw the expected product of each of the following reactions, including stereochemistry where appropriate. (2 points each)

a) ![Image of reaction]

b) ![Image of reaction]

c) ![Image of reaction]

d) ![Image of reaction]

e) ![Image of reaction]
5. For each of the transformations shown, select a set of reagents from the list (a-f) that can accomplish it. (1 point each)

a) $\text{R}_2\text{BH}, \text{then} \ H_2\text{O}_2, \text{NaOH}$

b) $\text{Hg(OAc)}_2, \text{H}_2\text{O}, \text{then} \ \text{NaBH}_4$

c) $\text{HCl}$

d) $\text{Br}_2$

e) $\text{H}_3\text{PO}_4, \text{H}_2\text{O}$

f) $\text{CH}_3\text{C(O)OOH}$

A

\[
\text{\begin{tikzpicture}
\draw (0,0) -- (1,0) -- (2,0); \draw (1,0) -- (2,1);
\draw (1,0) -- (2,-1);
\end{tikzpicture}} \rightarrow \text{\begin{tikzpicture}
\draw (0,0) -- (1,0) -- (2,0); \draw (1,0) -- (2,1);
\end{tikzpicture}}
\]

B

\[
\text{\begin{tikzpicture}
\draw (0,0) -- (1,0) -- (2,0);
\draw (1,0) -- (2,1);
\draw (1,0) -- (2,-1);
\end{tikzpicture}} \rightarrow \text{\begin{tikzpicture}
\draw (0,0) -- (1,0) -- (2,0); \draw (1,0) -- (2,1);
\draw (1,0) -- (2,-1);
\draw (1,1) -- (2,1);
\end{tikzpicture}}
\]

D

\[
\text{\begin{tikzpicture}
\draw (0,0) -- (1,0) -- (2,0); \draw (1,0) -- (2,1);
\draw (1,0) -- (2,-1);
\end{tikzpicture}} \rightarrow \text{\begin{tikzpicture}
\draw (0,0) -- (1,0) -- (2,0); \draw (1,0) -- (2,1);
\draw (1,0) -- (2,-1);
\draw (1,1) -- (2,1);
\draw (1,1) -- (2,-1);
\end{tikzpicture}}
\]

6. Draw the other two important resonance structures (those which do not generate new pairs of charges) for the anion shown. Rank the three resonance structures in order of importance, 1=high and 3=low. (4 points)

\[
\begin{align*}
3 & \quad \text{CH}_3\text{CH}_2\text{O} \rightleftharpoons \text{C} \rightleftharpoons \text{CH} \rightleftharpoons \text{C} \rightleftharpoons \text{N} \\
1 & \quad \text{CH}_3\text{CH}_2\text{O} \rightleftharpoons \text{C} \rightleftharpoons \text{CH} \rightleftharpoons \text{C} \rightleftharpoons \text{N} \\
2 & \quad \text{CH}_3\text{CH}_2\text{O} \rightleftharpoons \text{C} \rightleftharpoons \text{CH} \rightleftharpoons \text{C} \rightleftharpoons \text{N} \oplus
\end{align*}
\]
7. For each of the following pairs of structures, indicate whether they are **resonance structures** or **isomers**. (1 point each)

- Isomers

- Resonance structures