Worksheet 7, Chem 51C, Jarvo

1. a. Label the hybridization of each nitrogen.

   ![Chemical structures]

   a. Label the hybridization of each nitrogen.

   ![Chemical structures]

   b. Label each amine as 1°, 2°, or 3°

   ![Chemical structures]

   c. Rank from most to least acidic. For each compound, label with the pKₐ and draw the conjugate base.

   ![Chemical structures]

   d. Rank from most to least acidic. For each compound, label with the pKₐ and draw the conjugate base.

   ![Chemical structures]

   e. Draw the three-dimensional chair representations of the following carbohydrates:

   ![Chemical structures]

   What are the names of these compounds? What is the relationship between them?
2. Fill in the boxes with the appropriate starting material, reagent or major product. Show stereochemistry where appropriate.

a. 

\[
\begin{align*}
\text{H} & \quad \text{H} \\
\text{O} & \quad \text{O}
\end{align*}
\]

What is the name of this reaction?

b. 

\[
\begin{align*}
\text{HO} & \quad \text{OH} \\
\text{HO} & \quad \text{OH}
\end{align*}
\]

\[
\begin{align*}
\text{Ag}_2\text{O} & \quad \text{CH}_3\text{I} \\
\text{H}_3\text{O}^+ & \quad \text{H}_2\text{O}
\end{align*}
\]

What is the name of this reaction?

c. 

\[
\begin{align*}
\text{H}_3\text{C} & \quad \text{Br} \\
\text{H}_3\text{C} & \quad \text{Br}
\end{align*}
\]

\[
\begin{align*}
1. & \quad \text{HN} \\
2. & \quad \text{HN}
\end{align*}
\]

\[
\begin{align*}
\text{H}_3\text{C} & \quad \text{NH}_2 \\
\text{H}_3\text{C} & \quad \text{NH}_2
\end{align*}
\]

What is the name of this reaction?

d. 

\[
\begin{align*}
\text{NH}_3 & \quad \text{NaBH}_3\text{CN}
\end{align*}
\]

What is the name of this reaction?

e. 

\[
\begin{align*}
\text{O} & \quad \text{O}
\end{align*}
\]

\[
\begin{align*}
1. & \quad \text{HN} \\
2. & \quad \text{HN}
\end{align*}
\]

\[
\begin{align*}
\text{O} & \quad \text{CH}_3 \\
\text{O} & \quad \text{CH}_3
\end{align*}
\]

What is the name of this reaction?

+ enantiomers
3. Fill in the blank and provide an arrow-pushing mechanism.

a. 

\[ \text{Br} \quad \begin{array}{c}
\text{HN} \\
\text{O}
\end{array} \quad \xrightarrow{\text{1. } \text{HN}} \quad \begin{array}{c}
\text{O} \\
\text{H}
\end{array} \quad \xrightarrow{\text{2. NaOH, } \text{H}_2\text{O}} \quad \text{Blank}
\]

b. 

\[ \text{HO} \quad \begin{array}{c}
\text{O} \\
\text{H}
\end{array} \quad \xrightarrow{\text{HO}} \quad \begin{array}{c}
\text{OH} \\
\text{HCl}
\end{array} \quad \text{Blank}
\]

c. Provide a mechanism:

\[ \begin{array}{c}
\text{HO} \\
\text{H}
\end{array} \quad \xrightarrow{\text{H}_3\text{O}^+} \quad \begin{array}{c}
\text{HO} \\
\text{H}
\end{array} \quad \xrightarrow{\text{H}_3\text{O}^+} \quad \begin{array}{c}
\text{HO} \\
\text{H}
\end{array} \]
4. a. Show at least four different methods for synthesis of the amine below, each one from a different starting material.

\[ \text{NMe}_2 \]

b. In the following natural products, circle and label the following functional groups: lactam, amide, amine, \( \beta \)-hydroxyketone, 1,3-diol

- Gelsemine
  - Lactam: \( N \) atom
  - Amide: \( CO \) group
  - Amine: \( NH \) group
  - \( \beta \)-Hydroxyketone: \( CO \) group
  - 1,3-Diol: \( OH \) groups

- Rifamycin B
  - Lactam: \( N \) atom
  - Amide: \( CO \) group
  - Amine: \( NH \) group
  - \( \beta \)-Hydroxyketone: \( CO \) group
  - 1,3-Diol: \( OH \) groups

- Epothilone C
  - Lactam: \( N \) atom
  - Amide: \( CO \) group
  - Amine: \( NH \) group
  - \( \beta \)-Hydroxyketone: \( CO \) group
  - 1,3-Diol: \( OH \) groups
5. Propose syntheses of the targets shown below. **All carbons** in the product must come from the starting materials provided, you can use any reagent you wish.

Target A.

![Target A](image)

Target B.

![Target B](image)

Target C.

![Target C](image)

Target D.

![Target D](image)  (mixture of diastereomers and enantiomers)

Target E.

![Target E](image)  (racemic)

Target F.

![Target F](image)
6. Propose syntheses of the targets shown below. All carbons in the product must come from the starting materials provided, you can use any reagent you wish.