**Week 5 Worksheet**

**Important concepts**
- Wittig reaction
  - Preparation of a phosphonium ylide
  - Reaction with aldehydes and ketones
  - Synthesis with the wittig reaction
  - Understand the mechanisms to be able to determine products
- Addition of weak nucleophiles to alpha, beta unsaturated aldehydes and ketones
  - Know the mechanism
  - 1,2 vs 1,4
- Structure and properties of carboxylic acids
  - Boiling point
  - Acidity trends
    - Inductive effect trend
    - Understand the stability of the conjugate base
    - Bases that deprotonate carboxylic acids
- Reaction of nitriles
  - Acid catalyzed mechanism only
  - Understand reactivity of nitriles

**Problem Set**

1. Draw the products formed in each Wittig reaction. Draw all stereoisomers formed when a mixture of products results.

   a. 
   ![Wittig Reaction 1](image1)

   b. 
   ![Wittig Reaction 2](image2)
2. Rank the compounds in each group in order of increasing acidity.

a.

\[
\begin{align*}
\text{Cl} & \quad \text{COOH} \\
\text{Br} & \quad \text{COOH}
\end{align*}
\]

b.

\[
\begin{align*}
\text{OH} & \quad \text{OH} \\
\text{O}_2\text{N} & \quad \text{Cl}^{-} \\
\text{Br} & \quad \text{O}_2\text{N}
\end{align*}
\]

c.

\[
\begin{align*}
\text{OH} & \quad \text{OH} \\
\text{O}_2\text{N} & \quad \text{O}_2\text{N} \\
\text{Br} & \quad \text{NO}_2
\end{align*}
\]

3. Outline two different ways that 2-butanone can be prepared from a nitrile and Grignard reagent.
4. Draw a stepwise mechanism for the following reaction.

\[
\text{[Structure image]} \xrightarrow{\text{H}_2\text{O}^+} \text{[Structure image]}
\]

5. Devise a synthesis of each compound from cyclohexene and organic alcohols. You may use any other required organic and inorganic reagents.

\[
\text{[Structure image]}
\]

Target Compound
6. Draw the product of the following reaction and indicate the stereochemistry at any stereogenic centers.