1. **(12)** The following questions refer to the reaction scheme outlined in part a.
   (a) Triethylamine (shown over the arrow) acts as a weak base and reacts with the given ketone to give two different possible products, “Enolate A” and “Enolate B”. The yield ratio of A versus B is strongly temperature dependent. Given this information, fill in the missing structure.

   ![Reaction Scheme](image)

   

   T = –78 °C  
   T = +25 °C

   10% yield  
   90% yield  
   90% yield  
   10% yield

   (b) Enolate A is the (circle one): **thermodynamic product** / **kinetic product**

   (c) Suggest a base to favor the formation of only enolate A: ________________

2. **(8)** Shown below is the oxaphosphetane intermediate formed during the course of a Wittig reaction. Draw in the curly mechanism arrows that show the breakdown of this intermediate resulting in the major organic product. Also draw the organic product in the box provided.

   ![Oxaphosphetane](image)

3. **(8)** Determine the structure of Molecule A and fill in the missing pieces of the reactions, below, that will transform Molecule A into Molecules B and C.

   ![Reaction Scheme](image)
4. Fill in the boxes with the structures of the missing reagents, starting materials or products. For the boxes over the arrows, you may use any carbon containing starting material that will react with the given reactant to give the final product.

\[ \text{HCO}_2\text{H} + \square \rightarrow \text{NaOEt/ EtOH} \rightarrow \square \rightarrow \text{transesterification product} \]

\[ \text{CH}_3\text{CO}_2\text{H} \rightarrow 1. \text{SOCl}_2 \quad 2. \text{EtOH} \quad 3. \text{MeOH/H}^+ \rightarrow \square \rightarrow \text{may be more than one step!} \]

\[ \text{C}_7\text{H}_8\text{Cl} \rightarrow \square \rightarrow \text{C}_7\text{H}_8\text{NH}_2 \rightarrow \text{may be more than one step!} \]

\[ \text{CH}_3\text{O}_2\text{CO}_2\text{CH}_3 \rightarrow \square \rightarrow \text{CO}_2\text{H} \rightarrow \text{may be more than one step!} \]

\[ \text{C}_7\text{H}_8\text{CN} \rightarrow \text{H}_2\text{O/H}^+ \rightarrow \square \rightarrow \text{may be more than one step!} \]

\[ \text{C}_8\text{H}_8\text{O} \rightarrow \text{NaOEt/ EtOH / } \Delta \rightarrow \square \rightarrow \text{may be more than one step!} \]
5. **(25)** Draw the entire mechanism for the following transformation. Include all curly arrows and non-zero formal charges.

\[
\begin{align*}
\text{O} & \quad \text{H}_3\text{O}^+ \\
\rightarrow & \\
\text{H}_2\text{SO}_4 & 1 \text{ eq.}
\end{align*}
\]

6. **(20)** Complete the missing pieces of the following roadmap synthesis.
7. **(25)** The following cyclic molecule can be made from small, acyclic starting materials. Show a reasonable route for the total synthesis of the molecule using only the reactants provided as your sources of carbon. Note: you may use as many equivalents of any one reactant that you may need.

\[
\text{CH}_3\text{Br} \quad + \quad \text{CHO} \quad + \quad \text{CH}_3\text{CH}_2\text{C}==\text{C}\text{H} \quad \xrightarrow{\text{many steps}} \quad \text{O} \quad \text{O} \quad \text{O} \\
\]

*Hint: Although many routes are possible, one correct route can make use of the following types of reactions: haloform reaction, crossed Claisen, and Robinson Annulation.*