Multiple Choice

1. Choose the major product of the following reaction sequence.

\[
\begin{align*}
&\text{O} \quad \text{O} \\
&\text{Et} \quad \text{Et} \\
&\text{1. } \text{O} \text{Et} \\
&\text{2. } \text{Br} \\
&\text{1. } \text{O} \text{H/H}_2\text{O} \\
&\text{2. } \text{H}^-/\text{H}_2\text{O} \\
&\text{3. heat} \\
\end{align*}
\]

\[
\text{A} \quad \text{B} \quad \text{C} \quad \text{D} \quad \text{E}
\]

2. Choose the major product of the following reaction.

\[
\begin{align*}
&\text{O} \text{C} \text{O} \\
&\text{O} \text{C} \text{O} \\
&\text{NaOCH}_3 \\
&\text{HOCH}_3 \\
\end{align*}
\]

\[
\text{A} \quad \text{B} \quad \text{C} \quad \text{D} \quad \text{E}
\]

3. Choose the order that has the following compounds correctly arranged with respect to increasing basicity.

\[
\begin{align*}
&\text{NH}_2 \\
&\text{NH}_2 \\
&\text{NH}_2 \\
&\text{CH}_3 \\
&\text{i} \\
&\text{ii} \\
&\text{iii} \\
\end{align*}
\]

\[
\begin{align*}
&A \quad i < ii < iii \\
&B \quad ii < i < iii \\
&C \quad ii < iii < i \\
&D \quad iii < ii < i \\
&E \quad iii < i < ii \\
\end{align*}
\]

\[
\text{increasing basicity} \\
\text{increasing basicity} \\
\text{increasing basicity} \\
\text{increasing basicity} \\
\text{increasing basicity}
\]
4. A student tried to synthesize the benzamide shown below, but the reaction did not work very well and instead of pure product the student got a mixture of three compounds. Dr. Katsamanis suggested the following separation scheme, but he did not tell the student which flask he would find the amide.

Choose the letter that corresponds to the flask containing the benzamide.

5. Choose the reactants that would give the following ketone.

\[ \text{?} \xrightarrow{\Theta \text{OH/H}_2\text{O}} \]

\[
\begin{align*}
1 & \quad \text{CH}_3 \\
2 & \quad \text{H}_3\text{C} \\
3 & \quad \text{H} \\
4 & \quad \text{H} \\
\end{align*}
\]

A = 1 + 3  
B = 2 + 3  
C = 3 + 4  
D = 2 + 4  
E = 1 + 4
6. Choose the product of the following reaction.

\[
\begin{align*}
\text{NO}_2 \quad \text{Cl}_2 \quad \text{FeCl}_3 \\
\text{NO}_2 \quad \text{Br} \quad \text{Cl} \quad \text{Cl} \quad \text{Cl} \quad \text{Br} \quad \text{Br} \quad \text{Cl} \\
\text{A} \quad \text{B} \quad \text{C} \quad \text{D} \quad \text{E}
\end{align*}
\]

7. Choose those reactions that would be a good synthesis of the following amine.

\[
\begin{align*}
\text{?} \quad \text{?} \quad \text{?} \quad \text{?} \\
1. \text{LiAlH}_4 \quad 1. \text{LiAlH}_4 \\
2. \text{H}_2\text{O} \quad 2. \text{H}_2\text{O} \\
3. \text{NH}_3 \quad \text{NH}_3
\end{align*}
\]

\[
\begin{align*}
\text{A} = 1 \quad \text{B} = 2 \quad \text{C} = 3 \quad \text{D} = 1 + 2 \quad \text{E} = 2 + 3
\end{align*}
\]

8. Choose the most stable conjugate acid of pyrazole.

\[
\begin{align*}
\text{pyrazole} \quad \text{H}^+ \\
\text{A} \quad \text{B}
\end{align*}
\]
9. Choose the major product of the following reaction.

\[
\text{CH}_3\text{CCH}_2\text{CCH}_2\text{CH}_2\text{CO}_2\text{Me} \xrightarrow{\Theta \text{Me}} \text{CO}_2\text{Me} \xrightarrow{1. \Theta \text{Me}\text{OH}/\text{H}_2\text{O}} \xrightarrow{2. \text{H}/\text{H}_2\text{O}} \xrightarrow{3. \text{heat (-CO}_2\text{)}} \text{CO}_2\text{Me}
\]

10. Choose the major product of the following reaction sequence.

11. Give a method for converting ethyl acetate into compound A and give the structures of B in the following reaction sequence. 10 pts

12. Propose a method for performing the following transformation. 5 pts.

13. Propose a method for performing the following transformation. 5 pts.
14. Propose a synthesis of the following compound from ethyl acetoacetate and compounds containing four carbon atoms or less. 10 pts

\[
\begin{align*}
\text{CO} & \quad \text{O} \\
\text{CH}_2 & \quad \text{OEt} \\
\text{CH}_2 & \quad \text{OEt}
\end{align*}
\]

15. Using the curved arrow formalism show the bond breaking and bond making that occurs in the transformation. 10 pts

\[
\begin{align*}
\text{CH}_2 & + \quad \text{HOEt} + \quad \text{OCl} \\
\text{CO} & \quad \text{O} \\
\text{CH}_2 & \quad \text{OEt} \\
\text{Cl}
\end{align*}
\]

16. Using the curved arrow formalism show the bond breaking and bond making that occurs in the transformation (This is called a retro aldol reaction). 10 pts

\[
\begin{align*}
\text{CH}_2 & + \quad \text{HOEt} + \quad \text{OCl} \\
\text{CO} & \quad \text{O} \\
\text{CH}_2 & \quad \text{OEt} \\
\text{Cl}
\end{align*}
\]