1) Nomenclature. Write an unambiguous name of each compound or provide the structure for the compound.

A. Potassium Acetate  
B. N-ethyl-N-hexylpentanamide

C.  
D.  

E. Hexanoic Anhydride  
F.  

2) Answer the following miscellaneous questions.

A. The following reaction \( \text{Cl} \xrightarrow{\text{H}_2\text{N}-\text{R}} \text{N}-\text{R} \) runs well in neutral or basic conditions, but is very slow or unreactive in acidic conditions. Explain this observation.

B. Explain why acid chlorides are more reactive towards nucleophilic substitution than amides.

C. Circle all compounds below soluble in water.

\[
\text{OH} \quad \text{COOH} \quad \text{(Na)} \quad \text{C}_6\text{H}_{12}\text{O}_3\text{Na}^+ \quad \text{COOH}
\]
D. Explain why a Grignard reagent adds twice to acid chlorides, once to ketones, and not at all to carboxylic acids.

E. Circle the more acidic of each pair of compounds.

F. Explain which of the following is a better synthetic route.

\[ \text{OH} \xrightarrow{1. \text{NaH}} \xrightarrow{2. \text{Br}} \text{X} \]
3) Reactions. Provide the missing reagents, starting materials, or products for each reaction scheme.

A. \( \text{HCN} \xrightarrow{\text{KCN}} \text{C} = \text{N} \)

B. \( \text{NH}_2 \)

C. \( \text{Ph}_3\text{P}^- \xrightarrow{\text{CH}_2} \)

D. \( \text{N} \)

E. \( \text{Cl} \xrightarrow{(\text{CH}_3)\text{CuLi}} \)

F. \( \text{PCC} \xrightarrow{} \text{H} \)

G. \( \text{KMnO}_4 \)

H. \( \text{CN} \xrightarrow{} \text{NH}_2 \)

I. \( \xrightarrow{1. \text{MgBr}} \xrightarrow{2. \text{H}_3\text{O}^+} \)

J. \( \text{OH} \xrightarrow{\text{H}_2\text{N-CH}_3, \text{DCC}} \)
4) In the space below, write mechanisms using standard arrow-pushing notation for transformations.

A. \[
\text{CH}_3\text{CH(OH)CH}_2\text{OH} \xrightarrow{\text{HCl}} \text{CH}_3\text{CH(OH)CH}_2\text{OCH}_3
\]

B. \[
\text{CH}_3\text{CH(OH)CH}_2\text{OH} \xrightarrow{\text{HCl}} \text{CH}_3\text{CH(OH)CH}_2\text{OCH}_3
\]
5. Synthesis. Complete the multistep synthesis questions.

A. \[
\begin{array}{c}
\text{\includegraphics[width=1cm]{cyclic_structure}} \\
\text{\includegraphics[width=2cm]{cyclic_structure_B}}
\end{array}
\]

B. \[
\begin{array}{c}
\text{\includegraphics[width=1cm]{cyclic_structure_NH2}} \\
\text{\includegraphics[width=2cm]{cyclic_structure_B}}
\end{array}
\]

C. \[
\begin{array}{c}
\text{\includegraphics[width=1cm]{cyclic_structure_Br}} \\
\text{\includegraphics[width=2cm]{cyclic_structure_Br}}
\end{array}
\]