1. Synthesis Reactions. Draw the feature product of the following reactions. (3 pts each)
1. NaOH
2. SOCl₂
3. MeOH

1. NaOH
2. HCl

2. Draw the starting materials for the following hydrolysis reactions. (2 pts each)

3. a) Which one(s) of the following will react spontaneously with H₂O? (2 pts) O, E
   b) Which one(s) will react spontaneously with Me₂NH? (2 pts) [Note: there may be more than one that reacts.]
   A, O, E

4. Shown are two isomers. Circle the one with the higher boiling point. (2 points)
5. Provide Reagents for the Following Transformations (4 pts each)

\[
\begin{align*}
\text{Acetone} & \xrightarrow{1. \text{MeNH}_2, \Delta \text{ or } 1. \text{SOCl}_2} \text{N-Methylcyclopentanecarboxylic acid} \\
& \xrightarrow{2. \text{LiAlH}_4} \xrightarrow{3. \text{MeNH}_2} \xrightarrow{3. \text{LiAlH}_4} \text{N-Methylcyclopentanecarboxylic acid}
\end{align*}
\]

\[
\begin{align*}
\text{PhC(O)NHMe} & \xrightarrow{1. \text{NaOH}} \text{PhC(O)Ph} \\
& \xrightarrow{2. \text{SOCl}_2} \xrightarrow{3. \text{H}_2\text{O} + \text{Ph}} \text{PhC(O)Ph}
\end{align*}
\]

\[
\begin{align*}
\text{Propan-1-ol} & \xrightarrow{1. \text{H}_2\text{CrO}_4} \text{propan-1-amine} \\
& \xrightarrow{2. \text{MeNH}_2, \text{NaBH}_4, \text{CN}, \text{H}^+} \text{propan-1-amine}
\end{align*}
\]

\[
\begin{align*}
\text{Nitrobenzene} & \xrightarrow{1. \text{Br}_2, \text{FeBr}_3} \text{4-Bromo-3-chloroaniline} \\
& \xrightarrow{2. \text{Fe}, \text{HCl}} \xrightarrow{3. \text{NaNO}_2, \text{HCl}} \xrightarrow{4. \text{CuCl}} \text{4-Bromo-3-chloroaniline}
\end{align*}
\]

6. Name the Following or Draw the Structure (2 pts each)

a. \[\text{CH}_2=\text{CH}-\text{CH}_2-\text{CH}_2-\text{COOH}\] \[3\text{-amino butanoic acid}\]

b. N-methyl-N-ethyl-3-hexanamine
N-ethyl-N-methylhexan-3-amine

c. Methyl benzoate
7. Provide Mechanisms for the Following Reactions. (Note: In some cases, these may be “partial” reactions.) (16 points)
8. Which (if any) after being dissolved in diethyl ether, will: (4 points)
   a) Extract into NaOH/H₂O?  b) Extract into HCl/H₂O?  c) Extract into neutral water?  none

9. Of the following, which form would exist at: (4 points)
   a) pH = 2 (acidic)  b) pH = 7 (neutral)  c) pH = 12 (basic)  D

10. Rank the basicity of the three Nitrogen atoms, from most to least (1 most, 3 least). (2 pts)
    A > B > C

11. Rank the acidity of the following, 1 being most acidic, 3 being least (2 pts each)
    a. ethanoic acid 1  CH₃NH⁺Cl 2  ethanol 3
       O₂N H₂CO₂H  MeO H₂CO₂H  MeO H₂CO₂H
    b. 1  2  3

12. Rank the following in order of increasing basicity (2 points each)
    a. NH₃ 2  CH₃NH₂ 1  PhNH₂ 3
       
    b. NaOH 1  CH₃NH₂ 2  sodium ethanoate 3
       
    c. NH 1  N 2  N 3