Name:

1-10) are True or False (10pts)

1) Carboxylic acid derivatives are compounds that can be hydrolyzed to produce aldehydes and ketones.

2) Nitriles have an sp hybridized Nitrogen atom.

3) Esters undergo nucleophilic acyl substitution reactions.

4) KMnO₄ will convert acid chlorides to aldehydes.

5) Esters are more reactive than anhydrides in nucleophilic acyl substitution reactions.

6) Carboxylic acids can be reduced to primary alcohols by KMnO₄.

7) Nucleophilic acyl substitution reactions proceed through an octahedral intermediate.

8) Ketones can be reduced to primary alcohols by KMnO₄.

9) Esters have more resonance stability than amides.

10) Nitriles are more basic than secondary amines.

11-15) Name the following general classes of organic compounds. (5pts)

\[
\begin{align*}
\text{O} & \quad \text{R-C\text{O}\text{-H}} \\
\text{O} & \quad \text{R-C\text{O}\text{-C\text{-R}}} \\
\text{O} & \quad \text{R-C\text{-O\text{-OH}}} \\
\text{O} & \quad \text{R-C\text{-F}} \\
\text{O} & \quad \text{NH}
\end{align*}
\]

16) Put a cross through the molecule (above) which has the lowest pH. (1pt)
17) Circle the *strongest* acid in the following threesomes. (3pts)

(a) \( \text{CH}_3\text{C}-\text{O}_2\text{H} \quad \text{CH}_3\text{CH}_2\text{O}_2\text{H} \quad \text{CH}_3\text{CH}_2\text{O}-\text{O}-\text{H} \)

(b)  

(c)  

18) Circle the more reactive molecule with respect to *nucleophilic acyl substitution*. (3pts)

(a) \( \text{CH}_3\text{CH}_2\text{OH} \quad \text{CH}_3\text{O}--\text{C}--\text{CH}_3 \quad \text{CH}_3\text{O}--\text{C}--\text{CF}_3 \)

(b)  

(c)  

19) Write the mechanism (*i.e. curly arrows*) for the reaction of an alcohol with an anhydride, yielding an ester. (5pts)
20) Name the following compounds in IUPAC acceptable terms. (15pts)

\[ \text{CH}_2\text{OOC} \quad \text{Cl}\text{COOC} \quad \text{CH}_2\text{OOC} \]

\[ \text{NH}_2\text{CH}_2\text{CH}_2\text{COOH} \quad \text{O} \quad \text{C} \text{O} \]

21) Provide the two products (2+2pts) and the two sets of reagents (2+2pts) for these transformations. (8pts)

\[ \text{H}_3\text{C-C-H} \]

\[ \text{H}_3\text{C-C-OH} \xrightarrow{\text{CH}_3\text{CH}_2\text{OH, H}^+} 1) \text{excess LiAlH}_4 \]

\[ \text{H}_3\text{C-C-OH} \xrightarrow{} 2) \text{H}_2\text{O}^+ \]

\[ \text{H}_3\text{C-C-} \]

\[ \text{H}_3\text{C-C-} \]

\[ \text{H}_3\text{C-C-} \]

\[ \text{H}_3\text{C-C-} \]
****BONUS QUESTION (up to 3 points)****

Devise a synthetic scheme to generate the product from the starting material.

- **Diagram:**
  - Starting material: A cyclic compound.
  - Transformation steps:
    - Reaction 1: Introduction of a hydroxyl group (-OH).
    - Reaction 3: Introduction of a methyl group (-CH₃).
Name: SUMMER 2014

1-10) are True or False (10pts)

1) Carboxylic acid derivatives are compounds that can be hydrolyzed to produce aldehydes and ketones. F

2) Nitriles have an sp hybridized Nitrogen atom. T

3) Esters undergo nucleophilic acyl substitution reactions. T

4) KmnO₄ will convert acid chlorides to aldehydes. F

5) Esters are more reactive than anhydrides in nucleophilic acyl substitution reactions. F

6) Carboxylic acids can be reduced to primary alcohols by KmnO₄. F

7) Nucleophilic acyl substitution reactions proceed through an octahedral intermediate. F

8) Ketones can be reduced to primary alcohols by KmnO₄. F

9) Esters have more resonance stability than amides. F

10) Nitriles are more basic than secondary amines. F

11-15) Name the following general classes of organic compounds. (5pts)

- Carboxylic acid
- Anhydride
- Peroxyacid
- Acid fluoride
- Lactam

16) Put a cross through the molecule (above) which has the lowest pH. (1pt)
17) Circle the *strongest* acid in the following threesomees. (3pts)

(a) \( \text{CH}_3\text{-CO}_2\text{H} \) \( \text{CH}_3\text{CH}_2\text{-O-H} \) \( \text{CH}_3\text{CH}_2\text{-O-O-H} \)

(b) \[
\text{F} \quad \text{CO}_2\text{H} \\
\text{O} \quad \text{Cl} \\
\text{Cl} \quad \text{Cl}
\]

(c) \[
\text{Br} \quad \text{OH} \\
\text{Cl} \quad \text{CO}_2\text{H} \\
\text{CH}_3
\]

18) Circle the more reactive molecule with respect to *nucleophilic acyl substitution*. (3pts)

(a) \( \text{CH}_3\text{CH}_2\text{-OH} \) \( \text{CH}_3\text{-O-C-CH}_3 \) \( \text{CH}_3\text{-O-C-CF}_3 \)

(b) \[
\text{O} \\
\text{C-H} \\
\text{NH}
\]

(c) \[
\text{H}_3\text{C}-\text{C}-\text{O}-\text{CH}_3 \\
\text{H}_3\text{C}-\text{C}-\text{O-C-CH}_3 \\
\text{H}_3\text{C}-\text{C}-\text{O-C-CCH}_3
\]

19) Write the mechanism (*i.e. curly arrows*) for the reaction of an alcohol with an anhydride, yielding an ester. (5pts)

\[
\text{ROH} \quad \text{R} \quad \text{O} \quad \text{H} \quad \text{R} \\
\text{R-O-C-R'} \quad \text{R-O-C-R'} \quad \text{HO-R'}
\]
20) Name the following compounds in IUPAC acceptable terms. (15pts)

- Propanoic ethanoic anhydride
- 3-Bromo propanoyl chloride
- Ethyl propanoate
- 4-amino-5-fluoro propanoic acid
- 5-hydroxy propanoic acid lactone

21) Provide the two products (2+2pts) and the two sets of reagents (2+2pts) for these transformations. (8pts)
****BONUS QUESTION (up to 3 points)****

Devise a synthetic scheme to generate the product from the starting material.

\[ \text{Starting Material} \xrightarrow{\text{mcpba}} \xrightarrow{\text{NaNO}_3} \xrightarrow{\text{H}_2\text{O}} \xrightarrow{\text{LiAlH}_4} \xrightarrow{\text{H}_2\text{O}} \text{Product} \]