1. Nomenclature & Fundamentals

(a) (10 points) You were introduced to many reagents in this class that are more than just letters and numbers. These friends have names that help you understand how they participate in chemical reactions. Write the full name of each chemical on the line provided:

- NaCN \( \text{sodium cyanide} \)
- H\(_3\)O\(^+\) \( \text{hydronium} \)
- NH\(_3\) \( \text{ammonia} \)
- LiAlH\(_4\) \( \text{lithium aluminum hydride} \)
- Ac\(_2\)O \( \text{acetic anhydride} \)
- Py \( \text{pyridine} \)

(b) (10 points) Draw examples of your two favorite functional groups below using skeletal structures (no other abbreviations such as R groups). Draw two separate molecules and give the name of the functional group (not the IUPAC name of the molecule).

(c) (10 points) The Haworth projection of a monosaccharide is given below. Indicate whether the structure below is the alpha (\(\alpha\)) or beta (\(\beta\)) anomer on the small line provided. Convert this into a Fischer projection.

(d) (10 points) Complete the following Fischer, Haworth projections and chair conformations…

\(\alpha\)-D-Galactopyranose (the C4 epimer of D-Glucose)

(e) (5 points) Galactose and gulose (above) are examples of:

- Aldopentoses
- Ketopentoses
- Aldohexoses
- Ketohexoses
4. Mini-Puzzles. Fill in the missing molecules, paying close attention to the direction of the reaction arrow.

(a) (10 points) Show the starting materials for two different methods for making Histidine.

\[
\text{Histidine} \quad 1. \text{PBr}_3, \text{Br}_2 \\
2. \text{H}_2\text{O} \\
3. \text{Excess NH}_3
\]

(b) (10 points) Show the products of two different reactions of α-D-allopyranose.

\[
\text{α-D-Allopyranose} \quad \text{CH}_3\text{CH}_2\text{OH} \\
\text{H}_3\text{O}^+ \\
\text{CH}_3 (\text{excess}) \quad \text{Ag}_2\text{O}
\]

(c) (10 points) Show the products of both reactions to explain the need for N-acyl capping.

(d) (15 points) Draw the triacylglycerol product of the following reaction. You are welcome to abbreviate the hydrocarbon chain from the fatty acid.