1. Complete the following acid-base reaction and predict the direction of equilibrium (to the right or to the left) for each. (Acetic acid: pKa = 4.76, Pyridinium cation: pKa = 5.21)

\[ \text{AcOH} + \text{Py} \leftrightarrow \]  

2. Name the following using common nomenclature:

3. Provide the compound for each transformation:

- a. NaOEt, HOEt
- b. HCl, H2O
- c. heat

\[ \text{CH}_3\text{NO}_2, \text{NaOH} \]

- a. NaNO2, HCl
- Ni, H2
4. Propose a detailed mechanism to explain the following reaction:

\[ \text{Proposed Mechanism} \]

5. Devise a reasonable synthesis for the following compounds from reagents you are familiar with and the starting material provided.

**a.**

\[ \text{Proposed Synthesis a} \]

**b.**

\[ \text{Proposed Synthesis b} \]