Recitation problems: Acids/bases and Arrow Pushing

1. Rank the following sets of compounds in order of increasing acidity:

(a) \( \text{H-Se} \) \( \text{H-O} \) \( \text{H-S} \)

   \( \begin{array}{c}
   \text{I} \\
   \text{II} \\
   \text{III}
   \end{array} \)

Ranking: \( \text{II} \prec \text{III} \prec \text{I} \)

Reason(s): Size of atom, bond strength, these override electronegativity

(b) \( \text{CH}_3\text{C}=\text{CH}_2 \) \( \text{CH}_3\text{C}=\text{O} \) \( \text{CH}_3\text{C}=\text{O} \) \( \text{F}_3\text{C}=\text{O} \)

   \( \begin{array}{c}
   \text{I} \\
   \text{II} \\
   \text{III} \\
   \text{IV}
   \end{array} \)

Ranking: \( \text{I} \prec \text{II} \prec \text{III} \prec \text{IV} \)

Reason(s): I cannot do resonance, others can. Electroneg. helps stabilize conj. base of IV more than III more than II.

(c) \( \text{Pyridine} \) \( \text{Pyridine} \) \( \text{Pyridine} \)

   \( \begin{array}{c}
   \text{I} \\
   \text{II} \\
   \text{III}
   \end{array} \)

Ranking: \( \text{III} \prec \text{II} \prec \text{I} \)

Reason(s): Again I cannot do resonance, so that destabilizes the conj acid form making I more acidic. Other two ranked by reson. stabilization, III is the most stable acid form

2. Fill in the arrows for the following reactions:

(a) \( \text{CH}_3\text{C}=\text{O} \) \( \text{Li}^+ \)

   \( \begin{array}{c}
   \text{H}_3\text{C}=\text{C}=\text{O} \\
   \text{H}_3\text{C}=\text{C}=\text{O} \text{Li}^+
   \end{array} \)

   Bonds made: C-C
   Bonds broken: C-O (pi bond only), C-Li

(b) \( \text{Br}^- \) \( \text{H}^+ \)

   \( \begin{array}{c}
   \text{H}_3\text{C}=\text{O} \\
   \text{H}_3\text{C}=\text{O}^+ \text{H}^+
   \end{array} \)

   Bonds made: O-H
   Bonds broken: H-Br

3. Predict the product of the following reaction, based on the arrows shown:

   \( \text{This forms a new C-I bond} \)

   \( \begin{array}{c}
   \text{Cl}^- \\
   \text{Cl}^-
   \end{array} \)

   \( \begin{array}{c}
   \text{This breaks the C-Cl bond} \\
   \text{This forms a new C-I bond}
   \end{array} \)