ACID & BASE STRENGTH
Exit Ticket 11

1. Place the species in each of the following groups in order of increasing acid strengths. Give reasons for the orders you chose.

   a) $\text{H}_2\text{O}, \text{H}_2\text{S}, \text{H}_2\text{Se}$

   b) $\text{CH}_3\text{CO}_2\text{H}, \text{F}_3\text{CCO}_2\text{H}, \text{FCH}_2\text{CO}_2\text{H}, \text{F}_2\text{CHCO}_2\text{H}$

   c) $\text{NH}_4^+, \text{PH}_4^+$

2. Will the following oxides give acidic, basic or neutral solutions when dissolved in water? Write equations to justify your answers.

   a) $\text{CaO}$

   b) $\text{SO}_2$

   c) $\text{Cl}_2\text{O}$

3. Using your textbook for any information you need, calculate the equilibrium constant for the following aqueous reactions:

   a) $\text{NH}_3 + \text{H}_3\text{O}^+ \rightleftharpoons \text{NH}_4^+ + \text{H}_2\text{O}$

   b) $\text{HNO}_2 + \text{OH}^- \rightleftharpoons \text{NO}_2^- + \text{H}_2\text{O}$
4. Without relying on a pKa table, rank each set of compounds in order of decreasing acidity. (Note: Where there are more than one hydrogen, the acidic hydrogens are indicated in bold type). Give a reason for your choices.

a) \((\text{CH}_3)_2\text{P–H}\) \(\text{CH}_3\text{S–H}\) \(\text{Cl–H}\)

b) \(\text{NH}_4^+\) \(\text{H}_3\text{O}^+\)

5. Based on the information given, determine which direction the equilibrium favors in each reaction below. Give a rationale for your choices.

\[
\begin{align*}
\text{NH}_3 + \text{H}_2\text{O} & \rightleftharpoons \text{NH}_4^+ + \text{OH}^- \\
pK_a & = 15.7 \quad 9.2
\end{align*}
\]

\[
\begin{align*}
\text{CH}_3\text{CO}_2\text{H} + \text{NH}_3 & \rightleftharpoons \text{NH}_4^+ + \text{CH}_3\text{CO}_2^- \\
pK_a & = 4.8 \quad 9.2
\end{align*}
\]

\[
\begin{align*}
\text{NH}_3 + \text{HCN} & \rightleftharpoons \text{NH}_4^+ + \text{CN}^- \\
pK_a & = 9.4 \quad 9.2
\end{align*}
\]