CONCEPT: DIPROTIC ACIDS

Diprotic acids and bases are compounds that can donate or accept _____ H^+ ion.

For diprotic acids _____ their equations can be illustrated by:

$H_2A\ (aq) + H_2O\ (l) \rightleftharpoons HA^-\ (aq) + H_3O^+\ (aq)$ $\qquad K_{a1} = \dfrac{\text{Products}}{\text{Reactants}} =$

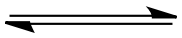
$HA^-\ (aq) + H_2O\ (l) \rightleftharpoons A^{2-}\ (aq) + H_3O^+\ (aq)$ $\qquad K_{a2} = \dfrac{\text{Products}}{\text{Reactants}} =$

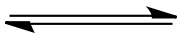
For diprotic bases _____ their equations can be illustrated by:

$A^{2-}\ (aq) + H_2O\ (aq) \rightleftharpoons HA^-\ (aq) + OH^-\ (aq)$ $\qquad K_{b1} = \dfrac{\text{Products}}{\text{Reactants}} =$

$HA^-\ (aq) + H_2O\ (aq) \rightleftharpoons H_2A\ (aq) + OH^-\ (aq)$ $\qquad K_{b2} = \dfrac{\text{Products}}{\text{Reactants}} =$

Based on these equations the relationship between the different forms of diprotic species are:





As a result of these equations for diprotic acids and bases the relationship between K_a and K_b will be:

$$K_{a1} \cdot K_{b2} = K_w$$

$$K_{a2} \cdot K_{b1} = K_w$$

When dealing with diprotic acids:

1) H_2A can be treated as a monoprotic acid and we use _____ can be used to find pH.

2) HA^- represents the intermediate form and we use _____ can be used to find pH.

3) A^{2-} represents the basic form and we use _____ can be used to find pH.

PRACTICE: DIPROTIC ACID CALCULATIONS 1

EXAMPLE 1: Sulfurous acid, H_2SO_3, represents a diprotic acid with a $K_{a1} = 1.6 \times 10^{-2}$ and $K_{a2} = 4.6 \times 10^{-5}$. Calculate the pH and concentrations of H_2SO_3, HSO_3^- and SO_3^{2-} when given 0.200 M H_2SO_3.

EXAMPLE 2: Determine the pH of 0.080 M Na_2S. Hydrosulfuric acid, H_2S, contains $K_{a1} = 1.0 \times 10^{-7}$ and $K_{a2} = 9.1 \times 10^{-8}$.

PRACTICE: DIPROTIC ACID CALCULATIONS 2

EXAMPLE: If $Ka_1 = 4.46 \times 10^{-7}$ and $Ka_2 = 4.69 \times 10^{-11}$ for H_2CO_3 what is the pH for a 0.15 M solution of $NaHCO_3$?

PRACTICE: An unknown diprotic acid has an initial concentration of 0.025 M. What is the pH of the solution if pka_1 is 3.25 and pKa_2 is 6.82?