Monoprotic Acids

\[ \alpha_0 = \frac{[H^+]^+ cK_a}{[H^+] + cK_a} = \frac{[HA]}{C_{T,A}} \quad (A1-1) \]

and

\[ \alpha_1 = \frac{cK_a}{[H^+] + cK_a} = \frac{[A^-]}{C_{T,A}} \quad (A1-2) \]

When ionic strength effects are negligible, \( cK_a = K_a \).

A1.2. IONIZATION FRACTIONS FOR MULTIPROTIC ACIDS

The exact equations for a diprotic acid, \( H_2A \), are

\[ \alpha_0 = \frac{[H^+]^2}{E} = \frac{[H_2A]}{C_{T,A}} \quad (A1-3) \]

\[ \alpha_1 = \frac{H^+] cK_{a,1}}{E} = \frac{[HA^-]}{C_{T,A}} \quad (A1-4) \]

\[ \alpha_2 = \frac{cK_{a,1} cK_{a,2}}{E} = \frac{[A^{2-}]}{C_{T,A}} \quad (A1-5) \]

where \( E = [H^+]^2 + [H^+] cK_{a,1} + cK_{a,1} cK_{a,2} \). When ionic strength effects are negligible, \( cK_{a,1} = K_{a,1} \) and \( cK_{a,2} = K_{a,2} \).

For the triprotic acid, \( H_3A \), the equations are:

\[ \alpha_0 = \frac{[H^+]^3}{D} = \frac{[H_3A^-]}{C_{T,A}} \quad (A1-6) \]

\[ \alpha_1 = \frac{[H^+]^2 cK_{a,1}}{D} = \frac{[H_2A^-]}{C_{T,A}} \quad (A1-7) \]
\[ \alpha_2 = \frac{[H^+]^c K_{a,1}^c K_{a,2}^c}{D} \frac{[HA^{2-}]}{C_{T,A}} \]  
(A1-8)

\[ \alpha_j = \frac{c K_{a,1} c K_{a,2} K_{a,3}^c}{D} \frac{[A^{3-}]}{C_{T,A}} \]  
(A1-9)

where

\[ D = [H^+]^3 + [H^+]^2 c K_{a,1} + [H^+] c K_{a,1} c K_{a,2} + c K_{a,1} c K_{a,2} c K_{a,3} \].

Again if ionic strength effects are negligible,

\[ c K_{a,1} = K_{a,1}, \quad c K_{a,2} = K_{a,2}, \quad \text{and} \quad c K_{a,3} = K_{a,3}. \]