

Tips for determining P_{CO_2} from $[DIC]$ and $[Alk]$.

1) Solve for $[H]$

$$\rightarrow Alk = HCO_3^- + 2CO_3^{2-}$$

$$\rightarrow DIC = HCO_3^- + CO_3^{2-}$$

$$\therefore Alk - DIC = CO_3^{2-}$$

$$\rightarrow CO_3^{2-} = \alpha_2 DIC \quad \text{Note}$$

-or-

$$\rightarrow CO_3^{2-} = \alpha_2 C_T$$

$$\rightarrow \alpha_2 = \frac{k_1 k_2}{H^2 + k_1 H + k_1 k_2}$$

$$\rightarrow CO_3^{2-} = C_T \frac{k_1 k_2}{H^2 + k_1 H + k_1 k_2}$$

$$\rightarrow CO_3 H^2 + CO_3 k_1 H + k_1 k_2 (CO_3 - C_T)$$

\rightarrow Use quadratic equation solution

$$\rightarrow H = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

2) Solve for H_2CO_3

$$\rightarrow H_2CO_3 = \alpha_0 C_T$$

$$\rightarrow \alpha_0 = \frac{H^2}{(H^2 + Hk_1 + k_1k_2)}$$

3) Use Henry's Law to solve for P_{CO_2}

$$\rightarrow H_2CO_3 = K_H P_{CO_2}$$