CE 326 Water Chemistry Calculations

1) Calculate the alkalinity (exactly), Part II

\[ \text{Alk} = [\text{HCO}_3^-] + [\text{CO}_3^{2-}] + [\text{OH}^-] - [\text{H}^+] \] mg/L as CaCO_3

\[ [\text{HCO}_3^-] = 422 \text{ mg/L} \times \left( \frac{50}{84} \right) = 245.90 \text{ mg/L as CaCO}_3 \]  - (1)

\[ [\text{CO}_3^{2-}] = 12 \text{ mg/L} \times \left( \frac{50}{84} \right) = 2 \text{ mg/L as CaCO}_3 \]  - (2)

\[ K_a = \frac{[\text{H}^+][\text{CO}_3^{2-}]}{[\text{HCO}_3^-]} \text{ mol/L} \]

\[ \text{pH} = 10 - 10.33 \]

\[ [\text{H}^+] = 1.62 \times 10^{-8} \text{ mol/L} \times \frac{1 \text{ mol}}{18 \text{ g}} \times \frac{1,000 \text{ mg}}{1 \text{ g}} \left( \frac{\text{mg}}{16 \text{ mg}} \right) = 0.1 \times 10^{-4} \text{ mg/L as CaCO}_3 \]  - (3)

\[ K_w = [\text{H}^+][\text{OH}^-] = [1.62 \times 10^{-8}] [\text{OH}^-] = 10^{-14} \]

\[ [\text{OH}^-] = 6.17 \times 10^{-7} \text{ mol/L} \times \frac{17 \text{ g}}{18 \text{ g}} \times \frac{1,000 \text{ mg}}{1 \text{ g}} \times \left( \frac{50}{18} \right) = 0.0309 \text{ mg/L as CaCO}_3 \]  - (4)

\[ \Delta \text{Alk} = 245.90 + 2 + 0.0309 - 8.1 \times 10^{-6} \text{ mg/L as CaCO}_3 \]

\[ = 247.93 \text{ mg/L as CaCO}_3 \]