

CE 326 Water Chemistry Calculations (1)

1) Calculate the alkalinity (exactly) Part II

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

$$\text{HCO}_3^- = 422 \text{ mg/L} \left(\frac{50}{61}\right) = 345.90 \text{ mg/L as CaCO}_3 \text{ --- (1)}$$

$$\text{CO}_3^{2-} = 1.2 \text{ mg/L} \left(\frac{50}{60}\right) = 2 \text{ mg/L as CaCO}_3 \text{ --- (2)}$$

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

$$10^{-10.33}$$

$$422 \text{ mg/L} \times \frac{1 \text{ mol}}{61 \text{ g}} \times \frac{1 \text{ g}}{1000 \text{ mg}} = 6.92 \times 10^{-3} \text{ mol/L}$$

$$1.2 \text{ mg/L} \times \frac{1 \text{ mole}}{60 \text{ g}} \times \frac{1 \text{ g}}{1000 \text{ g}} = 2 \times 10^{-5} \text{ mol/L}$$

$$\therefore 10^{-10.33}$$

$$= \frac{[\text{H}^+](2 \times 10^{-5})}{(6.92 \times 10^{-3})}$$

$$[\text{H}^+] = 1.62 \times 10^{-8} \text{ mol/L} \times \frac{1 \text{ g}}{\text{mol}} \times \frac{1000 \text{ mg}}{\text{g}} \left(\frac{50}{11}\right) = 8.1 \times 10^{-4} \text{ mg/L as CaCO}_3 \text{ --- (3)}$$

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

$$\therefore [\text{OH}^-] = 6.17 \times 10^{-7} \text{ mole/L} \times \frac{17 \text{ g}}{\text{mole}} \times \frac{1000 \text{ mg}}{\text{g}} \times \left(\frac{50}{19}\right) = 0.0309 \text{ mg/L as CaCO}_3 \text{ --- (4)}$$

$$\begin{aligned} \text{Alk} &= 345.90 + 2 + 0.0309 - 8.1 \times 10^{-4} \text{ mg/L as CaCO}_3 \\ &= 347.93 \text{ mg/L as CaCO}_3 \end{aligned}$$