



3-2) Water has 120 mg/L  $\text{HCO}_3^-$   
15 mg/L  $\text{CO}_3^{2-}$

$$\begin{array}{ll} \text{HCO}_3^- & \text{EW} = 61 \\ \text{CO}_3^{2-} & \text{EW} = 30 \\ \text{CaCO}_3 & \text{EW} = 50 \end{array}$$

$$\text{mg/L as CaCO}_3 = \text{mg/L as species} \left( \frac{\text{EW CaCO}_3}{\text{EW species}} \right)$$

$$\text{CO}_3^{2-} = 15 \text{ mg/L} \left( \frac{50}{30} \right) = 25 \text{ mg/L as CaCO}_3$$

$$\text{HCO}_3^- = 120 \text{ mg/L} \left( \frac{50}{61} \right) = 98.4 \text{ mg/L as CaCO}_3$$

$$\text{Alk} = 25 + 98.4 = 123.4 \text{ mg/L as CaCO}_3 \text{ approximately}$$

3-3) With water in 3-2) but with pH known, pH 9.43.

$$[\text{H}^+] = 10^{-9.43}; \quad 10^{-9.43} \frac{\text{mol}}{\text{L}} \left( \frac{15}{\text{mol}} \right) \left( \frac{1000 \text{ mg}}{\text{g}} \right) = 3.72 \times 10^{-7} \frac{\text{mg}}{\text{L}}$$

$$[\text{OH}^-] = \frac{10^{-14}}{10^{-9.43}} = 2.69 \times 10^{-5} \text{ mol/L}$$

$$2.69 \times 10^{-5} \text{ mol/L} \left( \frac{17 \text{ g}}{\text{mol}} \right) \left( \frac{1000 \text{ mg}}{\text{g}} \right) = 0.458 \frac{\text{mg}}{\text{L}} \text{ OH}^-$$

$$\text{mg/L as CaCO}_3 = \text{mg/L as species} \left( \frac{\text{EW CaCO}_3}{\text{EW species}} \right)$$

$$\text{H}^+ = 3.72 \times 10^{-7} \text{ mg/L} \left( \frac{50}{1} \right) = 1.86 \times 10^{-5}$$

$$\text{OH}^- = 0.458 \text{ mg/L} \left( \frac{50}{17} \right) = 1.35$$

$$\text{Alk} = 123.4 + 1.35 - 1.86 \times 10^{-5} = 124.7 \text{ mg/L as CaCO}_3$$