

1. Calculate as mg/L as CaCO₃

Page | part I

$$\text{Ca}^{2+}: 120 \text{ mg/L} \left(\frac{100/2}{40/2} \right) = 300 \text{ mg/L as CaCO}_3$$

$$\text{Mg}^{2+}: 39 \text{ mg/L} \left(\frac{100/2}{24/2} \right) = 162.5 \text{ mg/L as CaCO}_3$$

$$\text{Na}^+: 12.8 \text{ mg/L} \left(\frac{100/2}{23/1} \right) = 27.8 \text{ mg/L as CaCO}_3$$

$$\text{K}^+: 3.4 \text{ mg/L} \left(\frac{100/2}{39/1} \right) = 4.36 \text{ mg/L as CaCO}_3$$

$$\text{Fe}^{2+}: 6.2 \text{ mg/L} \left(\frac{100/2}{56/2} \right) = 11 \text{ mg/L as CaCO}_3$$

$$\text{Mn}^{2+}: 0.3 \text{ mg/L} \left(\frac{100/2}{55/2} \right) = 0.55 \text{ mg/L as CaCO}_3$$

$$\text{HCO}_3^-: 422 \text{ mg/L HCO}_3^- \left(\frac{100/2}{61/1} \right) = 346 \text{ mg/L as CaCO}_3$$

$$\text{SO}_4^{2-}: 101 \text{ mg/L} \left(\frac{100/2}{96/2} \right) = 105 \text{ mg/L as CaCO}_3$$

$$\text{Cl}^-: 32 \text{ mg/L} \left(\frac{100/2}{35.5/1} \right) = 45.07 \text{ mg/L as CaCO}_3$$

$$\text{CO}_3^{2-}: 1.2 \text{ mg/L} \left(\frac{100/2}{60/2} \right) = 2 \text{ mg/L as CaCO}_3$$

2. Calculate the hydrogen ion concentration:

$$\text{HCO}_3^- = 422 \frac{\text{mg}}{\text{L}} \times \frac{1 \text{ mole}}{61 \text{ g}} \times \frac{1 \text{ g}}{1000 \text{ mg}} = 6.92 \times 10^{-3} \text{ mol/L}$$

$$\text{CO}_3^{2-} = 1.2 \text{ mg/L} \times \frac{1 \text{ mole}}{60 \text{ g}} \times \frac{1 \text{ g}}{1000 \text{ mg}} = 2.0 \times 10^{-5} \text{ mol/L}$$

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

$$a. \quad 10^{-10.33} = \frac{[\text{H}^+][2.0 \times 10^{-5}]}{[6.92 \times 10^{-3}]} \Rightarrow [\text{H}^+] = 1.62 \times 10^{-8} \text{ mol/L}$$

$$b. \quad 1.62 \times 10^{-8} \text{ mol/L} \times \frac{1 \text{ g}}{\text{mole}} \times \frac{1000 \text{ mg}}{\text{g}} = 1.62 \times 10^{-5} \text{ mg/L}$$