CH3041 Tutorial 3 Water Chemistry B

Name:

1. Define the **E_H of a solution** and the pE of a solution and explain how they are related.

2. Calculate the **ion activity product** for $CaSO_4$ in seawater using the concentrations Ca^{2+} 10 mmol L^{-1} and SO_4^{2-} 28 mmol L^{-1} , the activity coefficients are $\gamma Ca^{2+} = 0.73$ and $\gamma SO_4^{2-} = 0.49$. At 25°C the value of K_{SP} for $CaSO_4$ is 2.6×10^{-5}. Calculate the **degree of saturation** of $CaSO_4$ and predict if this compound is under-saturated or over-saturated in seawater.

3. Using the **Nernst equation** ($p\varepsilon = p\varepsilon^o - 1/n \log(\{red\}/\{ox\})$ calculate the pε value for an anoxic water containing 10^{-6} M Fe^{2+} in equilibrium with $Fe(OH)_3(s)$ at a pH of 4. Use concentrations as they closely approximate activities in this situation. The value of the equilibrium constant for the dominant redox 1/2 reaction: $Fe(OH)_{3(s)} + 3H^+ + e^- \leftrightarrows Fe^{2+} + 3H_2O$ is $K = 1 \times 10^{16}$. Recall that $p\varepsilon^o = 1/n \log K$.

4. Colourless sulphur bacteria may be classed as **chemotrophs**, **autotrophs** and **lithotrophs** which use O_2 as an oxidant. Explain what these terms mean and how these metabolic demands will effect where these organisms exist in the water column and the chemistry in their vicinity.

5. What is **redox cycling** at an **oxic-anoxic boundary**? Use an example to illustrate your answer.