TOPIC: Fate & Transport

DATE:

FILE UNDER: Problem Set 5 2016

1. Following the examples given in class lecture notes, calculate the pH of the mixed water from last week's P.set 4.

$S = 0, 10, 20, 30$

Assume river pH = 6.6 and Alk = 2×10^{-5} N as in the notes.

DO USE interpolated activity coefficients

NOTE: One simplification. In notes we "unapplied" γ_1 to $\{H^+\}$ in correcting K_{a1} but then we went back and re-applied γ_1 to $[H^+]$ to get $\{H^+\}$ and pH.

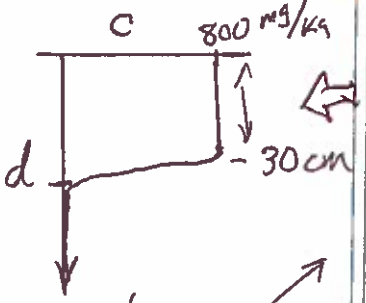
You can eliminate this double, cancelling out process. Just leave $\{H^+\}$ in the equilibrium equation, hence use only one γ_1

2. What is the solubility of Ca^{2+} in the estuary at $S = 0, 10, 20, 30$ assuming saturation of seawater with $CaCO_{3(s)}$?
Again, use interpolated values of γ's but WATCH OUT for VALENCE.
Also Solj is correct as mol/L so you want Conc = $[Ca^{2+}]$, not activity as with pH.

3. KINETICS: Find the rate of accumulation (input from sediments for a stratified pond which has sediments containing CdS solids.
The hypolimnion is anoxic, so no oxidation of sulfide occurs. Hence, simpler kinetics

(con'd)

3. (Cont'd)



(NEEDED to find total MASS of CONT. Sediment)

POND: Bottom area 5,000 m^2
Hypolimnion depth = 2.0 m

Sediments: Total CdS (as mg-Cd/kg) = 800 mg-Cd/kg

CONTAMINATED DEPTH = 30 cm

BULK DENSITY OF SEDIMENT $\rho_B = 1.6 \frac{kg}{L}$

Specific surface area of CdS solids = 3.0 $m^2 g^{-1}$

Rate coefficient for CdS dissln = 4.6×10^{-10} mol $m^{-2} s^{-1}$

a) Find the flow of Cd from sediments in units like mg/d (or appropriately scaled mass units)

b) If the hypolimnion is initially clean, $[Cd^{2+}] \simeq 0$ and no input or output show a plot of $[Cd^{2+}]$ vs time over 1 year.

c) How long will it take for one-half of the Cd^{2+} to dissolve out of the sediments? (Half-life)