Notes for EDTA Titration of Calcium and Magnesium in Seawater

R. Corn – Chem M3LC. Fall 2015

Approximate concentrations in seawater:

$[Mg^{2+}] = 60$ mM

$[Ca^{2+}] = 10$ mM

$Mg(OH)_{2(s)}$: $K_{sp} = 1.5 \times 10^{-11}$

$Ca(OH)_{2(s)}$: $K_{sp} = 5.5 \times 10^{-6}$

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At what pH will Magnesium Hydroxide start to precipitate?

$K_{sp} = [Mg^{2+}] [OH^-]^2$

$1.5 \times 10^{-11} = (0.060) [OH^-]^2$

$[OH^-] = 1.58 \times 10^{-5}$

pH = 9.20

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At what pH will Calcium Hydroxide start to precipitate?

$K_{sp} = [Ca^{2+}] [OH^-]^2$

$5.5 \times 10^{-6} = (0.010) [OH^-]^2$

$[OH^-] = 2.35 \times 10^{-2}$

pH = 12.37

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How much Mg2+ will remain in solution at a pH of 11.0?

$K_{sp} = [Mg^{2+}] [OH^-]^2$

$1.5 \times 10^{-11} = [Mg^{2+}] [1 \times 10^{-3}]^2$

$[Mg^{2+}] = 1.5 \times 10^{-5}$ M

Or $100 \times (1.5 \times 10^{-5})/(0.060) = 0.25\%$ of the total Mg^{2+} seawater concentration.

>99% removal of the Mg^{2+}!

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Use EDTA for both, or EGTA for second Ca only titration.

For EDTA, $\log K_f$ (Ca) = 10.70 ; $\log K_f$ (Mg) = 8.69