# Mass Action & Mass Balance

$$\beta_i = \frac{[CL]^c[H^+]^n}{[C]^c[HL]^l} \qquad mCa^{2+} = \sum mCa^{2+}L_x^n$$

- $mCa^{2+} = mCa^{2+} + MCaCl^{+} + mCaCl_2^{0} + CaCL_3^{-} + CaHCO_3^{+} + CaCO_3^{0} + CaF^{+} + CaSO_4^{0} + CaHSO_4^{+} + CaOH^{+} + \ldots$

- Final equation to solve the problem sees the mass action for each complex substituted into the mass balance equation

# Mineral dissolution/precipitation

- To determine whether or not a water is saturated with an aluminosilicate such as K-feldspar, we could write a dissolution reaction such as:
- $KAlSi_3O_8 + 4H^+ + 4H_2O \leftrightarrow K^+ + Al^{3+} + 3H_4SiO_4^0$
- We could then determine the equilibrium constant:

$$K = \frac{a_{K^+} a_{Al^{3+}} a_{H_4SiO_4}^3}{a_{H^+}^4}$$

- from Gibbs free energies of formation. The *IAP* could then be determined from a water analysis, and the saturation index calculated.

# INCONGRUENT DISSOLUTION

- Aluminosilicate minerals usually dissolve incongruently, e.g.,

$$2KAlSi_3O_8 + 2H^+ + 9H_2O$$
$$\leftrightarrow Al_2Si_2O_5(OH)_4 + 2K^+ + 4H_4SiO_4^0$$

- As a result of these factors, relations among solutions and aluminosilicate minerals are often depicted graphically on a type of mineral stability diagram called an activity diagram.