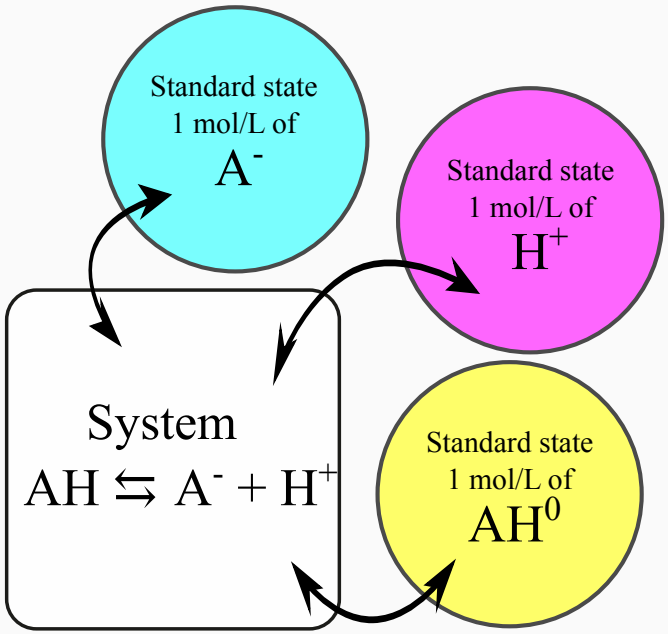
# Grand-reaction ensemble.

$$\Delta\Omega = k_B T \ln\left(K^{\xi} \prod_i V^{\nu_i \xi} \frac{N_i!}{(N_i + \nu_i \xi)!}\right) + \Delta E$$

$$K = e^{-\sum_i \nu_i \mu_i^{\ominus}}$$

$$\mathrm{HA} \overset{K}{\leftrightarrows} \mathrm{A^-} + \mathrm{H^+}$$

$$K = \mu^{\ominus}_{\mathrm{H^+}} + \mu^{\ominus}_{\mathrm{A^-}} - \mu^{\ominus}_{\mathrm{HA}}$$




$$\emptyset \leftrightarrows \mathrm{Na^+} + \mathrm{Cl^-}$$

$$K = \mu_{\mathrm{Na^+}} + \mu_{\mathrm{Cl^-}}$$

$$\emptyset \leftrightarrows \mathrm{Ca^{2+}} + 2\mathrm{Cl^-}$$

$$K = 2\mu_{\mathrm{Ca^{2+}}} + \mu_{\mathrm{Cl^-}}$$