

Physical Sciences 3

Lectures 21 and 22 - April 30, 2008 - Boltzmann Distribution, Entropy, Chemical Reactions

BOLTZMANN DISTRIBUTION

$$\frac{n_i}{n_j} = \frac{g_i}{g_j} e^{-(\epsilon_i - \epsilon_j)/kT}$$

of particles in a particular state (j) $\leftarrow \frac{n_i}{n_j}$
 degeneracy, the # of ways particles can be in state j $\leftarrow \frac{g_i}{g_j}$
 energy of state j $\leftarrow e^{-(\epsilon_i - \epsilon_j)/kT}$

$S = \text{entropy} = R \ln(\# \text{ of ways})$

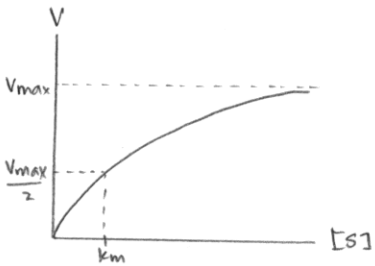
$\Delta G = \Delta H - T\Delta S$

of ways to choose two locations out of a total of n locations:

$$\frac{(n-1)(n)}{2}$$

total fraction of dimer pairs = $\frac{n_{\text{dimers}}}{n_{\text{total}}}$
 BUT! when the # of monomers is much greater than the # of dimers then $n_{\text{total}} \sim n_{\text{monomers}}$

MICHAELIS-MENTON



k_m = defined as the substrate concentration at $\frac{1}{2} V_{\text{max}}$

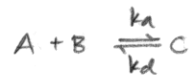
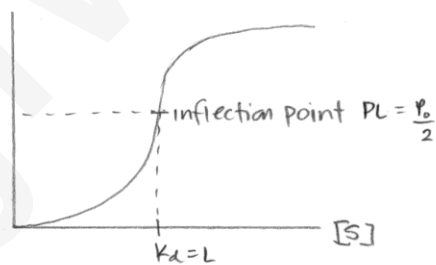
V_{max} = maximum rate reached



$V = \frac{V_{\text{max}}[S]}{k_m + [S]}$ and $V_{\text{max}} = k_{\text{cat}}[E] \therefore V = \frac{k_{\text{cat}}[S][E]}{k_m + [S]}$

SIGMOIDAL CURVES

Enzyme kinetics



$k_d = 1/k_a$

$k_d = \frac{[A][B]}{[C]}$

$P_0 = P + PL$

$L_0 = L + PL$

$\therefore k_d = L_0 - \frac{P_0}{2}$