Chapter 2

$f = n - 1$
$t = \frac{\overline{x}-\mu}{s}\sqrt{n}$
$-t_\alpha(f) < t < t_\alpha(f)$
$(\overline{x} - t_\alpha(f)\frac{s}{\sqrt{n}}, \overline{x} + t_\alpha(f)\frac{s}{\sqrt{n}})$
$u = \frac{\overline{x}-\mu}{\sigma}\sqrt{n}$
$-u_\alpha < u < u_\alpha$
$(\overline{x} - u_\alpha\frac{\sigma}{\sqrt{n}}, \overline{x} + u_\alpha\frac{s}{\sqrt{\sigma}})$
$F = \frac{s^2_{big}}{s^2_{small}}$
$s_p = \sqrt{\frac{s_1^2(n_1-1)+s_2^2(n_2-1)}{n_1+n_2-2}}$
$f = n_1 + n_2 - 2$
$t = \frac{|\overline{x_2}-\overline{x_1}|}{s_p}\sqrt{\frac{n_1 n_2}{n_1+n_2}}$
$s_d = \sqrt{\frac{\Sigma(d_i-\overline{d})^2}{n-1}}$
$t = \frac{\overline{d}-<d>}{s_d}\cdot\sqrt{n} \quad <d>=0$
$Q_{calc} = \frac{|x_q-x_n|}{x_{max}-x_{min}}$
$G_{calc} = \frac{|x_q-\overline{x}|}{s}$
$\frac{x_q-\overline{x}_{exclude}}{\overline{d}_{exclude}} \geq 4$

Chapter 3

$[H^+] = \frac{c_a+\sqrt{c_a^2+4K_w}}{2} \approx c_a (c > 10^{-6} mol/L)$
$[H^+] = \sqrt{K_{a(HA)} + K_w}$
$[H^+] = \sqrt{K_a c} \quad cK_a \geq 20K_w \quad \frac{c}{K_a} > 400$
$[H^+] = \frac{-K_a+\sqrt{K_a^2+4K_a c}}{2} \quad cK_a \geq 20K_w \quad \frac{c}{K_a} \leq 400$
$[H^+] = \sqrt{K_a c + K_w} \quad cK_a < 20K_w \quad \frac{c}{K_a} > 400$

$[H^+] = \sqrt{\frac{K_{a_1}(K_{a_2}c+K_w)}{c+K_{a_1}}}$
$[H^+] = \sqrt{\frac{K_{a_1}(K_{a_2}c+K_w)}{c}} \quad cK_{a2} < 20K_w \quad \frac{c}{K_{a1}} \geq 20$
$[H^+] = \sqrt{\frac{K_{a_1}K_{a_2}c}{c+K_{a_1}}} \quad cK_{a2} \geq 20K_w \quad \frac{c}{K_{a1}} < 20$
$[H^+] = \sqrt{K_{a_1}K_{a_2}} \quad cK_{a2} \geq 20K_w \quad \frac{c}{K_{a1}} \geq 20$
$[H^+] = \frac{(c_{sa}-K_{wa})+\sqrt{(c_{sa}-K_{wa})^2+4K_{wa}(c_{sa}+c_{wa})}}{2} \approx c_a \quad (c_a > 20[A^-])$
$[H^+] = \sqrt{K_{HA}c_{HA} + K_{HB}c_{HB}} \approx \sqrt{K_{HA}c_{HA}}$
$[H^+] = K_a\frac{c_a+[OH^-]-[H^+]}{c_b+[H^+]-[OH^-]} = K_a\frac{c_a-[H^+]}{c_b+[H^+]} = K_a\frac{c_a+[OH^-]}{c_b-[OH^-]} = K_a\frac{c_a}{c_b}$
$\beta = (2.303[H^+] + 2.3[OH^-]) + 2.3\frac{cK_a[H^+]}{([H^+]+K_a)^2} = 2.3\delta_1\delta_2 c$
$E_t = \frac{[H^+]_{ep}-[OH^-]_{ep}}{c_{sp,base}} \times 100\% = \frac{10^{-\Delta pH}-10^{\Delta pH}}{\sqrt{K_t}\times c_{sp,base}}$
$E_t = \frac{[OH^-]_{ep}-[H^+]_{ep}}{c_{sp,acid}} \times 100\% = \frac{10^{\Delta pH}-10^{-\Delta pH}}{\sqrt{K_t}\times c_{sp,acid}}$
$E_t = \frac{[OH^-]_{ep}-[Acid]_{ep}}{c_{sp,acid}} \times 100\% = \frac{[OH^-]_{ep}}{c_{sp,acid}} - \delta_{Acid} \times 100\% = \frac{10^{\Delta pH}-10^{-\Delta pH}}{\sqrt{K_t \times c_{sp,acid}}}$
$E_t = \frac{[H+]_{ep}-[Base]_{ep}}{c_{sp,base}} \times 100\% = \frac{[H^+]_{ep}}{c_{sp,base}} - \delta_{base} \times 100\% = \frac{10^{-\Delta pH}-10^{\Delta pH}}{\sqrt{K_t \times c_{sp,base}}}$
$E_t = \frac{10^{\Delta pH}-10^{-\Delta pH}}{\sqrt{K_{a1}/K_{a2}}}$

Chapter 4

$K_n = \frac{[ML_n]}{[ML_{n-1}][L]} \quad \beta_n = K_1 K_2 \cdots K_n = \frac{[ML_n]}{[M][L]^n}$
$[ML_n] = \beta_n [M][L]^n$
$c_M = [M](1 + \beta_1[L] + \beta_2[L]^2 + \cdots + \beta_n[L]^n) \quad \delta_{ML_n} = \delta_M \beta_n [L]^n$
$\alpha_Y = \frac{[Y']}{[Y]} = \alpha_{Y(H)} + \alpha_{Y(N)} - 1 \approx \alpha_{Y(H)} + \alpha_{Y(N)}$
$\alpha_Y \approx \alpha_{Y(H)} = \frac{[Y]+[HY]+[H_2Y]+\cdots+[H_6Y]}{[Y]} = \frac{1}{\delta_Y}$
$\alpha_{Y(H)} = 1 + \sum_{i=1}^{n}\beta_i^H[H]^i \ \alpha_{Y(N)} = \frac{[Y']}{[Y]} = 1 + K_{NY}[N]$
$\alpha_{Y(N_1,N_2,\cdots N_n)} = \alpha_{Y(N_1)} + \alpha_{Y(N_2)} + \cdots \alpha_{Y(N_n)} - (n-1)$
$\alpha_{M(L)} = \frac{[M']}{[M]} = 1 + \sum_{i=1}^{n}\beta_i[L]^i \quad \alpha_{M(OH)} = \frac{[M']}{[M]} = 1 + \sum_{i=1}^{n}\beta_i[OH]^i$
$\alpha_M = \alpha_{M(L)} + \alpha_{M(A)} - 1$
$\alpha_M = \alpha_{M(L_1)} + \alpha_{M(L_2)} + \cdots \alpha_{M(L_n)} - (n-1)$
$\alpha_{MY(H)} = 1 + K^H_{MHY}[H] \quad \alpha_{MY(OH)} = 1 + K^{OH}_{M(OH)Y}[OH]$
$K'_{MY} = K_{MY}\cdot\frac{\alpha_{MY}}{\alpha_M\alpha_Y} \quad \alpha = \frac{A'}{[A]}$
$lgK'_{MY} = lgK_{MY} - lg\alpha_M - lg\alpha_Y + lg\alpha_{MY} \approx lgK_{MY} - lg\alpha_M - lg\alpha_Y \approx lgK_{MY'} = lgK_{MY} - lg\alpha_{Y(H)}$
$pM = lgK_{ML} - lg\alpha_{L(H)} + lg\frac{[L']}{[ML]} \quad [M] = \frac{1}{K_{ML'}}\frac{[ML]}{[L']} = \frac{\alpha_{L(H)}}{K_{ML}}\frac{[ML]}{[L']}$
$[M']_{sp} = \sqrt{\frac{c_{sp,M}}{K'_{MY}}} \quad pM'_{sp} = \frac{1}{2}[lgK'_{MY} + p(c_{sp,M})]$
$pM_t = lgK_{MIn'} = lgK_{MIn} - lg\alpha_{In(H)}$
$E_t = \frac{10^{\Delta pM'}-10^{-\Delta pM'}}{\sqrt{K'_{MY}\cdot c_{sp,m}}} \times 100\% = \frac{10^{\Delta pM}-10^{-\Delta pM}}{\sqrt{K'_{MY}\cdot c_{sp,m}}} \times 100\%$
$= (\frac{1}{[M']_{ep}\cdot K'_{MY}} - \frac{[M']_{ep}}{c_{sp,M}}) \times 100\%$
$lgK'_{MY} = lgK_{MY} - lg\alpha_{Y(N)} = lgK_{MY} - lgK_{NY} - lg\frac{c_N}{\alpha_{N(A)}} = \Delta lgK + p(c_N) + lg\alpha_{N(A)}$

Chapter 5

$\varphi = \varphi^\Theta + \frac{0.059}{n}lg\frac{\gamma_{Ox}\alpha_{Red}}{\gamma_{Red}\alpha_{Ox}} + \frac{0.059}{n}lg\frac{c_{Ox}}{c_{Red}}$
$\varphi^{\Theta'} = \varphi^\Theta + \frac{0.059}{n}lg\frac{\gamma_{Ox}\alpha_{Red}}{\gamma_{Red}\alpha_{Ox}}$
$\varphi = \varphi^{\Theta'} + \frac{0.059}{n}lg\frac{c_{Ox}}{c_{Red}} \approx \varphi^\Theta + \frac{0.059}{n}lg\frac{\alpha_{Red}}{\alpha_{Ox}} + \frac{0.059}{n}lg\frac{c_{Ox}}{c_{Red}} = \varphi^\Theta + \frac{0.059}{n}lg\frac{\delta_{Ox}}{\delta_{Red}} + \frac{0.059}{n}lg\frac{c_{Ox}}{c_{Red}} = \varphi^\Theta + \frac{0.059}{n}lg\frac{[Ox]}{[Red]}$
$lgK' = lg[(\frac{c_{Red_1}}{c_{Ox_1}})^{n_1}(\frac{c_{Red_2}}{c_{Ox_2}})^{n_2}] = \frac{(\varphi_1^{\Theta'}-\varphi_2^{\Theta'})n_1n_2}{0.059} = \frac{(\varphi_1^{\Theta'}-\varphi_2^{\Theta'})n}{0.059}$
$(n_1+n_2)\varphi_{sp} = n_1\varphi_1^{\Theta'} + n_2\varphi_2^{\Theta'} + 0.059lg\frac{c_{sp,Ox_1}c_{sp,Ox_2}}{c_{sp,Red_1}c_{sp,Red_2}}$
$\varphi_{sp} = \frac{n_1\varphi_1^{\Theta'}+n_2\varphi_2^{\Theta'}}{n_1+n_2}$

Chapter 6

$K = \frac{a_{M^+}\cdot a_{A^-}}{a_{MA(aq.)}}$
$K^\Theta_{sp} = a_{M^+}\cdot a_{A^-} = K\cdot s^o \rightarrow$
$K_{sp} = [M^+][A^-] = \frac{a_{M^+}}{\gamma_{M^+}}\cdot\frac{a_{A^-}}{\gamma_{A^-}} = \frac{K^\Theta_{sp}}{\gamma_{M^+}\cdot\gamma_{A^-}}$
$K'_{sp} = K_{sp}\cdot\alpha_M\cdot\alpha_A$
$s = [M'] = [A'] = \sqrt{K'_{sp}}$
$K'_{sp} = K_{sp}\cdot\alpha_M^m\cdot\alpha_A^n$
$s = \sqrt[m+n]{\frac{K'_{sp}}{m^m\cdot n^n}}$