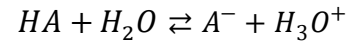


### Svag enprotonig syra + svag enprotonig bas

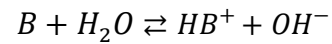


$$K_a = \frac{[A^-][H_3O^+]}{[HA]_2} \Leftrightarrow [A^-] = \frac{K_a[HA]_2}{[H_3O^+]}$$

$$[HA]_1 = [HA]_2 + [A^-] = [HA]_2 + \frac{K_a[HA]_2}{[H_3O^+]} = [HA]_2 \left( 1 + \frac{K_a}{[H_3O^+]} \right) = [HA]_2 \left( \frac{[H_3O^+] + K_a}{[H_3O^+]} \right) \Leftrightarrow$$

$$[HA]_2 = \frac{[HA]_1}{\left( \frac{[H_3O^+] + K_a}{[H_3O^+]} \right)} = \frac{[HA]_1[H_3O^+]}{[H_3O^+] + K_a}$$

$$K_w = [OH^-][H_3O^+] \Leftrightarrow [OH^-] = \frac{K_w}{[H_3O^+]}$$



$$K_b = \frac{[HB^+][OH^-]}{[B]_2} \Leftrightarrow [HB^+] = \frac{K_b[B]_2}{[OH^-]} = \frac{K_b[B]_2}{\frac{K_w}{[H_3O^+]}} = \frac{K_b[B]_2[H_3O^+]}{K_w}$$

$$[B]_1 = [B]_2 + [HB^+] = [B]_2 + \frac{K_b[B]_2}{[OH^-]} = [B]_2 \left( 1 + \frac{K_b}{[OH^-]} \right) = [B]_2 \left( \frac{[OH^-] + K_b}{[OH^-]} \right) \Leftrightarrow$$

$$[B]_2 = \frac{[B]_1}{\left( \frac{[OH^-] + K_b}{[OH^-]} \right)} = \frac{[B]_1[OH^-]}{[OH^-] + K_b}$$

$$[B]_2 = \frac{[B]_1 \frac{K_w}{[H_3O^+]}}{\frac{K_w}{[H_3O^+]} + K_b} = \frac{\frac{[B]_1 K_w}{[H_3O^+]}}{\frac{K_w + K_b [H_3O^+]}{[H_3O^+]}} = \frac{[B]_1 K_w}{K_w + K_b [H_3O^+]}$$

$$[HB^+] + [H_3O^+] = [OH^-] + [A^-]$$

$$\frac{K_b [B]_2 [H_3O^+]}{K_w} + [H_3O^+] = \frac{K_w}{[H_3O^+]} + \frac{K_a [HA]_2}{[H_3O^+]}$$

$$\frac{K_b [B]_2 [H_3O^+]^2}{K_w} + [H_3O^+]^2 = K_w + K_a [HA]_2$$

$$K_b [B]_2 [H_3O^+]^2 + K_w [H_3O^+]^2 = K_w^2 + K_w K_a [HA]_2$$

$$K_b [H_3O^+]^2 \frac{[B]_1 K_w}{K_w + K_b [H_3O^+]} + K_w [H_3O^+]^2 = K_w^2 + K_w K_a \frac{[HA]_1 [H_3O^+]}{[H_3O^+] + K_a}$$

$$\frac{K_w K_b [H_3O^+]^2 [B]_1}{K_w + K_b [H_3O^+]} + K_w [H_3O^+]^2 = K_w^2 + \frac{K_w K_a [HA]_1 [H_3O^+]}{[H_3O^+] + K_a}$$

$$\frac{K_b [H_3O^+]^2 [B]_1}{K_w + K_b [H_3O^+]} + [H_3O^+]^2 = K_w + \frac{K_a [HA]_1 [H_3O^+]}{[H_3O^+] + K_a}$$

$$K_b [H_3O^+]^2 [B]_1 + K_w [H_3O^+]^2 + K_b [H_3O^+]^3 = K_w^2 + K_w K_b [H_3O^+] + \frac{K_w K_a [HA]_1 [H_3O^+] + K_a K_b [HA]_1 [H_3O^+]^2}{[H_3O^+] + K_a}$$

$$\begin{aligned} K_b [H_3O^+]^3 [B]_1 + K_w [H_3O^+]^3 + K_b [H_3O^+]^4 + K_a K_b [H_3O^+]^2 [B]_1 + K_a K_w [H_3O^+]^2 + K_a K_b [H_3O^+]^3 \\ = K_w^2 [H_3O^+] + K_w K_b [H_3O^+]^2 + K_a K_w^2 + K_w K_a K_b [H_3O^+] + K_w K_a [HA]_1 [H_3O^+] + K_a K_b [HA]_1 [H_3O^+]^2 \end{aligned}$$

$$K_b[H_3O^+]^3[B]_1 + K_w[H_3O^+]^3 + K_b[H_3O^+]^4 + K_aK_b[H_3O^+]^2[B]_1 + K_aK_w[H_3O^+]^2 + K_aK_b[H_3O^+]^3 - K_w^2[H_3O^+] - K_wK_b[H_3O^+]^2 - K_aK_w^2 - K_wK_aK_b[H_3O^+] - K_wK_a[HA]_1[H_3O^+] - K_aK_b[HA]_1[H_3O^+]^2 = 0$$

$$K_b[H_3O^+]^4 + [H_3O^+]^3(K_b[B]_1 + K_w + K_aK_b) + [H_3O^+]^2(K_aK_b[B]_1 + K_aK_w - K_wK_b - K_aK_b[HA]_1) - [H_3O^+](K_w^2 + K_wK_aK_b + K_wK_a[HA]_1) - K_aK_w^2 = 0$$

$$K_b[H_3O^+]^4 + [H_3O^+]^3(K_b([B]_1 + K_a) + K_w) + [H_3O^+]^2(K_aK_b([B]_1 - [HA]_1) + K_w(K_a - K_b)) - [H_3O^+](K_wK_a(K_b + [HA]_1) + K_w^2) - K_aK_w^2 = 0$$