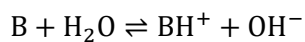


A pH \gg pK_a (eg. by 2 units)

$$ST = [B] + [BH^+]$$

$$[B] = S_0$$



$$K_b = \frac{[BH^+] \cdot [OH^-]}{[B]}$$

$$K_a = \frac{K_w}{K_b} = [H_3O^+] \cdot [OH^-] \cdot \frac{[B]}{[BH^+] \cdot [OH^-]} = \frac{[B] \cdot [H_3O^+]}{[BH^+]} = \frac{S_0 \cdot [H_3O^+]}{[BH^+]}$$

$$[BH^+] = \frac{S_0 \cdot [H_3O^+]}{K_a}$$

$$ST = S_0 + \frac{S_0 \cdot [H_3O^+]}{K_a}$$

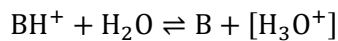
$$ST = S_0 \cdot \left(1 + \frac{[H_3O^+]}{K_a} \right)$$

A pH \ll pK_a (eg. by 2 units)

$$ST = [B] + [BH^+]$$

$$[BH^+] = \sqrt{K_{ps}}$$

$$K_{ps} = [BH^+] \cdot [Cl^-]$$



$$K_a = \frac{[B] \cdot [H_3O^+]}{[BH^+]}$$

$$[B] = \frac{[BH^+] \cdot K_a}{[H_3O^+]} = \frac{\sqrt{K_{ps}} \cdot K_a}{[H_3O^+]}$$

$$ST = \frac{\sqrt{K_{ps}} \cdot K_a}{[H_3O^+]} + \sqrt{K_{ps}}$$

$$ST = \sqrt{K_{ps}} \cdot \left(1 + \frac{K_a}{[H_3O^+]} \right)$$