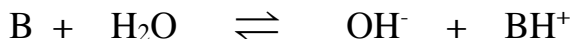


TYPE 1 (base)

(only B is put into solution)

For a weak base (B) in water:



$$K_b = \frac{[OH^-][BH^+]}{[B]} \quad \text{and let } C_B \text{ be the analytical concentration (label) of the weak base}$$

Our Equilibrium "ICE" Table

	[B]	[OH ⁻]	[BH ⁺]
initial	C_B	0	0
change	$-x$	$+x$	$+x$
equilibrium	$C_B - x$	x	x

$$K_b = \frac{x^2}{(C_B - x)} \quad \text{Equation 1.1}$$

$$K_b C_B - K_b(x) = x^2$$

$$0 = x^2 + K_b(x) - K_b C_B$$

$$[OH^-] = [BH^+] = x = \frac{-K_b + \sqrt{K_b^2 + 4K_b C_B}}{2}$$

This equation is the exact solution for calculating the [OH⁻] for any solution made by mixing a concentration of ONLY a weak base in water. (What I have designated a "Type 1" problem)

If we are using a REASONABLE concentration for B (somewhere between 1.0 M and 0.05 M) AND K_b is small enough (say less than 10^{-4}) we can make the following assumption:

$$C_B - x \cong C_B \quad \text{all this is saying is that } x \text{ is so small compared to } C_B, \text{ it doesn't change it}$$

So that Equation 1.1 shown above becomes

$$K_b = \frac{x^2}{C_B}$$

and solving:

$$[OH^-] = [BH^+] = x = \sqrt{K_b C_B} \quad \text{Equation 1.2}$$

This equation is the approximate solution for calculating the [OH⁻] for any weak base with $K_b < 10^{-4}$ when put in water.