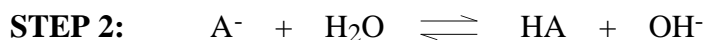
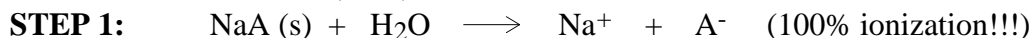


TYPE 1 (conj. BASE of weak acid)

(only the SALT of a weak acid put in solution)

For a salt of a weak acid (NaA) in water:



Note that A^- behaves EXACTLY like a weak base in water (a Type 1 problem for bases) and the equilibria is

$$K_b = \frac{[\text{OH}^-][\text{HA}]}{[\text{A}^-]} \quad \text{and remember } K_b \text{ for } \text{A}^- \text{ must be calculated from } K_a \text{ for HA: } K_b = \frac{K_w}{K_a}$$

Now let C_{A^-} be the analytical concentration (label) of the conjugate base, A^- :

Our Equilibrium "Chart"

	$[\text{A}^-]$	$[\text{OH}^-]$	$[\text{HA}]$
initial	C_{A^-}	0	0
change	$-x$	$+x$	$+x$
final	$C_{\text{A}^-} - x$	x	x

$$K_b = \frac{x^2}{(C_{\text{A}^-} - x)} \quad \text{Equation 3.1}$$

$$K_b C_{\text{A}^-} - K_b(x) = x^2$$

$$0 = x^2 + K_b(x) - K_b C_{\text{A}^-}$$

$$[\text{OH}^-] = [\text{A}^-] = x = \frac{-K_b + \sqrt{K_b^2 + 4K_b C_{\text{A}^-}}}{2}$$

This equation is the exact solution for calculating the $[\text{OH}^-]$ for any solution made by mixing a concentration of ONLY a conjugate weak base, A^- , in water.

If we are using a REASONABLE concentration for A^- (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:

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

$$K_b = \frac{x^2}{C_{\text{A}^-}}$$

and solving:

$$[\text{OH}^-] = [\text{HA}] = x = \sqrt{K_b C_{\text{A}^-}} \quad \text{Equation 3.2}$$

This equation is the approximate solution for calculating the $[\text{OH}^-]$ for any conjugate base, A^- , of the weak acid, HA, where $K_b < 10^{-4}$.