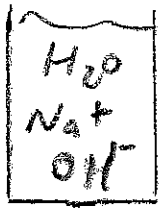
pH Calculation of Strong Base Solution

What is pH of a 0.10 M NaOH solution?

Step 1 = 

H_2O, Na^+, OH^-

Step 2

$NaOH \rightarrow Na^+ + OH^-$ $\quad K_b = \infty$

$H_2O + H_2O \rightleftharpoons H_3O^+ + OH^-$ $\quad K_w = 1.0 \times 10^{-14}$

Since NaOH is a strong base, NaOH will dissociate completely into Na^+ and OH^-. Therefore, there is NO Equilibrium but STOICHIOMETRY.

$$[OH^-] = (0.10\ M\ NaOH)\left(\frac{1\ mol\ OH^-}{1\ mol\ NaOH}\right) = 0.10\ M$$

Step 6 $\quad [OH^-][H^+] = 1.0 \times 10^{-14}\ M^2 \Rightarrow [H^+] = \dfrac{1.0 \times 10^{-14}\ M^2}{[OH^-]}$

$$[H^+] = \frac{1.0 \times 10^{-14}\ M^2}{0.10\ M} = 1.0 \times 10^{-13}\ M$$

$$pH = -\log[H^+] = -\log(1.0 \times 10^{-13}\ M) = -(-13.000) = 13.000$$

$$\boxed{pH = 13.00}$$