Answer on Question #67594, Chemistry, General Chemistry

Determine the pH change when 0.118 mol NaOH is added to 1.00 L of a buffer solution that is 0.472 M in HClO and 0.234 M in ClO-.

Solution:

This buffer solution is a mixture of a weak acid HClO and a salt of this acid - ClO-.
The pH value of buffer system we can calculate, using Henderson - Hasselbalch equation:

$pH = pKa + \lg\frac{C(ClO-)}{C(HClO)}$, where pKa = - lg Ka (Ka is acid constant dissociation).

$Ka(HClO) = 5.01 \cdot 10^{-8}$

We can determine the pKa value:

$pKa = - \lg 5.01 \cdot 10^{-8} = 7.3$

So, plug in values to find

$pH_1 = 7.3 + \lg\frac{0.234}{0.472} = 6.995$

When NaOH is added, the concentration of HClO is decreased, because the neutralization reaction is:

$NaOH + HClO \rightarrow NaClO + H_2O$

Thus, number of moles of salt NaClO is increased:

$n_2(ClO^-) = 0.118 + 0.234 = 0.352$ (moles)

The new value of pH is:

$pH_2 = 7.3 + \lg\frac{0.352}{0.472} = 7.17$

Now we can determine the pH change:

$\Delta pH = pH_2 - pH_1 = 7.17 - 6.995 = 0.175$

Answer: $\Delta pH = 0.175$.