

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:

$$\text{pH} = \text{pKa} + \lg \frac{c(\text{ClO}^-)}{c(\text{HClO})}, \text{ where } \text{pKa} = -\lg K_a \text{ (} K_a \text{ is acid constant dissociation).}$$

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

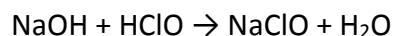
We can determine the pKa value:

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

So, plug in values to find

$$\text{pH}_1 = 7.3 + \lg \frac{0.234}{0.472} = 6.995$$

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



Thus, number of moles of salt NaClO is increased:

$$n_2(\text{ClO}^-) = 0.118 + 0.234 = 0.352 \text{ (moles)}$$

The new value of pH is:

$$\text{pH}_2 = 7.3 + \lg \frac{0.352}{0.472} = 7.17$$

Now we can determine the pH change:

$$\Delta\text{pH} = \text{pH}_2 - \text{pH}_1 = 7.17 - 6.995 = 0.175$$

Answer: $\Delta\text{pH} = 0.175$.