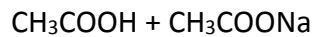


Answer on Question #67054, Chemistry, General Chemistry

0.4 mol of acetic acid and x mol of sodium acetate are dissolved in enough water to provide 1.0 L of a buffer system. How much sodium acetate must be added to provide a buffer system with where pH=4.1.

Solution:

Acetate buffer system consists of weak organic acetic acid and salt of this acid:



The pH value of buffer solution equals

$$\text{pH} = \text{pKa} + \lg \frac{C(\text{CH}_3\text{COONa})}{C(\text{CH}_3\text{COOH})}, \text{ where } \text{pKa} = -\lg K_a \text{ (} K_a \text{ is dissociation constant of acetic acid; } \text{pKa} = -\lg 1.74 \cdot 10^{-5} = 4.76)$$

Using given data, we can calculate the ratio $\frac{C(\text{CH}_3\text{COONa})}{C(\text{CH}_3\text{COOH})}$:

$$\lg \frac{C(\text{CH}_3\text{COONa})}{C(\text{CH}_3\text{COOH})} = \text{pH} - \text{pKa} = 4.1 - 4.76 = -0.66$$

So:

$$\frac{C(\text{CH}_3\text{COONa})}{C(\text{CH}_3\text{COOH})} = 0.219 \quad (1)$$

We can determine the molar concentration of acetic acid, using formula:

$$C(\text{CH}_3\text{COOH}) = \frac{n}{V}, \text{ where } n \text{ is number of moles; } V \text{ is volume.}$$

That's why:

$$C(\text{CH}_3\text{COOH}) = \frac{0.4}{1.0} = 0.4 \text{ (mol)}$$

According to equation (1):

$$\frac{C(\text{CH}_3\text{COONa})}{0.4} = 0.219$$

$$\text{Where } C(\text{CH}_3\text{COONa}) = 0.219 \cdot 0.4 = 0.0876 \text{ (mol/L)}$$

Thus, number of moles of sodium acetate:

$$n(\text{CH}_3\text{COONa}) = C(\text{CH}_3\text{COONa}) \cdot V = 0.0876 \cdot 1.0 = 0.0876 \text{ (mol)}$$

Answer: $n(\text{CH}_3\text{COONa}) = 0.0876 \text{ (mol)}$.

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