

Question #67345, Chemistry

A solution is made by adding 70.00grams of sodium acetate to 400.0mL of 0.60 mol/L solution of acetic acid.

a. What is the pH of the solution?

System described above is the buffer solution. pH of such kind of solutions calculates by the following formula:

$$pH = 7 + \frac{1}{2}pK_a + \frac{1}{2}lgC_{NaAc}$$

where

$$pK_a = -lgK_{HAc} = 4.76[1]$$

$$C_{NaAc} = \frac{m(NaAc)}{M(NaAc) * V} = \frac{70}{82.03 * 0.4} = 2.13 \text{ mol/L}$$

$$pH = 7 + \frac{1}{2} * 4.76 + \frac{1}{2}lg2.13 = 9.5441$$

b. 10.0mL of 2.0M of sodium hydroxide solution was added to the solution above. calculate the new pH.

So, concentration of sodium acetate was changed:

$$C'_{NaAc} = \frac{C_{NaAc} * V + C_{NaOH} * V_{NaOH}}{V + V_{NaOH}} = \frac{2.13 * 0.4 + 0.01 * 2}{0.41} = 2.126$$

$$pH = 7 + \frac{1}{2} * 4.76 + \frac{1}{2}lg2.126 = 9.5438$$

c. 10.0mL of 2.0M of hydrochloric solution was added to the solution in part a. Calculate the new pH.

in this case pH calculates with the following formula:

$$pH = 7 + lgC'_{HCl} + \frac{1}{2}pK_a + \frac{1}{2}lgC_{NaAc}$$

$$C'_{HCl} = \frac{C_{NaAc} * V_{HCl}}{V + V_{HCl}} = \frac{0.01 * 2}{0.41}$$

$$pH = 7 - 1.31 + 2.38 + 0.16 = 8.23$$

[1] Ripin, D. H.; Evans, D. A. (4 November 2005). "[pKa Table](#)" (PDF). Archived from [the original](#) (PDF) on 22 July 2015. Retrieved 19 July 2015.