Answer on Question #56388 – Chemistry – General Chemistry

Question:

A buffer is made by dissolving HC2H3O2 and NaC2H3O2 in water.

Write an equation that shows how this buffer neutralizes added acid.
Express your answer as a chemical equation. Identify all of the phases in your answer.
?????

Write an equation that shows how this buffer neutralizes added base.
Express your answer as a chemical equation. Identify all of the phases in your answer.
????
Calculate the pH of this buffer if it is 0.22 M HC2H3O2 and 0.45 M C2H3O2−. The Ka for HC2H3O2 is 1.8×10−5.
Express your answer using two decimal places.
pH = ???

Solution:

Processes of dissociation in the solution containing weak CH_3COOH acid and its salt:

$$CH_3COOH \rightleftarrows CH_3COO^- + H^+ \qquad Ka = 1{,}8*10^{-5}$$
$$CH_3COONa \rightarrow CH_3COO^- + Na^+$$

At addition of acid in solution ions of hydrogen communicate in weak acid:

$$H^+ + CH_3COO^- \rightleftarrows CH_3COOH$$

At addition of the basis in solution hydroxide ions communicate in weak electrolyte – water:

$$H^+ + OH^- \rightleftarrows H_2O$$

The constant of dissociation of acid is equal

$$K_a = \frac{[H^+][CH_3COO^-]}{[CH_3COOH]}$$

Then $[H^+] = K_a\frac{[CH_3COOH]}{[CH_3COO^-]}$

As degree of dissociation of acetic acid $\alpha << 1$, equilibrium concentration $c[CH_3COOH]$ is approximately equal to initial concentration with $c(CH_3COOH)$, and equilibrium concentration acetate ions $[CH_3COO\text{-}]$ is approximately equal to initial concentration of acetate of sodium with (CH_3COONa):

$[CH_3COOH] = c(CH_3COOH),\ [CH_3COO^-] = c(CH_3COONa).$

Then $[H^+] = K_a\frac{C(CH_3COOH)}{C(CH_3COONa)}$

After logarithming and multiplication on (-1) we will receive

$pH = -\lg Ka - \lg\frac{C(CH_3COOH)}{C(CH_3COONa)} = -\lg(1.8*10^{-5}) - \lg(0.22/0.45) = 5.06$

Answer: pH of a buffer it is equal 5.06.