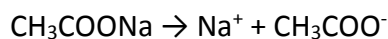
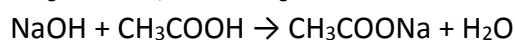
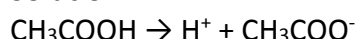


### Answer on Question #50111 – Chemistry – Physical Chemistry

In a buffer solution of 1 L there are 0.1 mole of  $\text{CH}_3\text{COOH}$  and 0.005 mole of  $\text{CH}_3\text{COONa}$ . In this solution 0.08 g of  $\text{NaOH}$  is mixed. What is the pH of the solution after mixing base?  $K_a$  of  $\text{CH}_3\text{COOH}$  is  $1.8 \times 10^{-5}$ .

#### Solution:



$$K_a = \frac{[\text{H}^+] \times [\text{CH}_3\text{COO}^-]}{[\text{CH}_3\text{COOH}]}$$
$$c = \frac{n}{V}$$

$$n = \frac{m}{M_r} = \frac{0.08 \text{ g}}{40 \text{ g/mol}} = 0.002 \text{ mol}$$

Lets  $[\text{H}^+] = x$ , then  $[\text{CH}_3\text{COOH}] = c_0 - x$

$[\text{CH}_3\text{COO}^-] = x + y$ ,  $y$  is part of anions from salt.

$$K_a = \frac{x \times (x + y)}{c_0 - x}$$

$$x^2 + (K_a + y) \times x - K_a \times c_0 = 0$$

Before adding base:

$$c_0 = \frac{0.1}{1} = 0.1 \text{ M}$$

$$y = \frac{0.005}{1} = 0.005 \text{ M}$$

So,

$$x^2 + (0.000018 + 0.005) \times x - 0.000018 \times 0.1 = 0$$

$$x^2 + 0.005018 \times x - 0.0000018 = 0$$

$$D = 0.005018^2 + 4 \times 1 \times 0.0000018 = 0.000032380324$$

$$x = \frac{-0.005018 + \sqrt{0.000032380324}}{2 \times 1} = 0.0003361856$$

$[\text{H}^+] = 0.0003361856 \text{ M}$

$$\text{pH} = -\log_{10}[\text{H}^+] = -\log_{10} 0.0003361856 = 3.47$$

After adding base:

$$c_0 = \frac{0.1 - 0.002}{1} = \frac{0.098}{1} = 0.098 \text{ M}$$

$$y = \frac{0.005 + 0.002}{1} = \frac{0.007}{1} = 0.007 \text{ M}$$

So,

$$x^2 + (0.000018 + 0.007) \times x - 0.000018 \times 0.098 = 0$$

$$x^2 + 0.007018 \times x - 0.000001764 = 0$$

$$D = 0.007018^2 + 4 \times 1 \times 0.000001764 = 0.000056308324$$

$$x = \frac{-0.007018 + \sqrt{0.000056308324}}{2 \times 1} = 0.0002429439$$

$[\text{H}^+] = 0.0002429439 \text{ M}$

$$\text{pH} = -\log_{10}[\text{H}^+] = -\log_{10} 0.0002429439 = 3.61$$

#### Answer:

After adding of base pH=3.61