

Calculate the pH of the buffer solutions below:

0.2 M CH₃COONa / 0.2 M CH₃COOH

Select one:

a. pH = 4.74

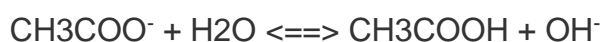
b. pH = 3.5

c. pH = 2

d. pH = 5

Solution:

1. Treat this as a base hydrolysis problem since CH₃COO⁻ is the conjugate base of CH₃COOH.



$$K_b = K_w / K_a = 1 \times 10^{-14} / 1.8 \times 10^{-5} = 5.6 \times 10^{-10};$$

$$5.6 \times 10^{-10} = \frac{x^2}{0.2-x}$$

$$x = 0.1 \times 10^{-4}$$

$$\text{pH} = \lg(0.1 \times 10^{-4}) = -5$$

$$2. K_a(\text{CH}_3\text{COOH}) = 1.8 \times 10^{-5}$$

$$1.8 \times 10^{-5} = \frac{x^2}{0.2-x}$$

$$x = 1.9 \times 10^{-3}$$

$$\text{pH} = \lg(1.9 \times 10^{-3}) = -2.72$$

$$3. \text{pH} = \frac{-5}{-2.72} = 2$$

Answer: c. pH=2.