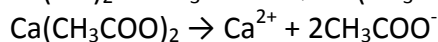
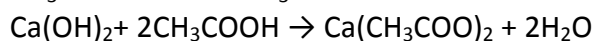
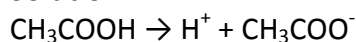


Answer on Question #50110 – Chemistry – Physical Chemistry

30 cm³ 0.05 M Ca(OH)₂ and 100 cm³ 0.1 M CH₃COOH are mixed. What is the pH of this buffer solution? K_a of CH₃COOH is 1.8×10⁻⁵.

Solution:



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

Lets [H⁺]=x, then [CH₃COOH]=c₀-x

[CH₃COO⁻]=x+y, y is part of anions from salt.

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

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

$$n(\text{Ca(OH)}_2) = c \times V = 0.05 \times 0.03 = 0.0015 \text{ mol}$$

$$n(\text{CH}_3\text{COOH}) = c \times V = 0.1 \times 0.1 = 0.01 \text{ mol}$$

Acid reacts with base, 2×0.0015 moles spends:

$$c_0 = \frac{0.01 - 2 \times 0.0015}{0.1 + 0.03} = \frac{0.007}{0.13} = 0.053846 \text{ M}$$

$$y = \frac{2 \times 0.0015}{0.1 + 0.03} = \frac{0.003}{0.13} = 0.023077 \text{ M}$$

So,

$$x^2 + (0.000018 + 0.023077) \times x - 0.000018 \times 0.053846 = 0$$

$$x^2 + 0.023095 \times x - 0.000000969228 = 0$$

$$D = 0.023095^2 - 4 \times 1 \times 0.000000969228 = 0.000537255937$$

$$x = \frac{-0.023095 + \sqrt{0.000537255937}}{2 \times 1} = 0.00004189$$

[H⁺]=0.00004189 M

$$\text{pH} = -\log_{10}[\text{H}^+] = -\log_{10} 0.00004189 = 4.38$$

Answer:

pH=4.38