

# Introduction to Buffers:

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What is the concentration of all species at equilibrium in a solution prepared by mixing 1.0 mL of 1 M formic acid and 1.00 g of sodium formate and diluting to 250 mL?

Constants Used:

$$M := \frac{\text{mole}}{\text{liter}} \quad K_w := 1.0 \cdot 10^{-14} \cdot M^2$$

Given a buffer prepared from a weak acid where (Input appropriate value here):

$$K_a := 1.8 \cdot 10^{-4} \cdot M$$

The concentration of the acid in the buffer is (Fill in values and delete unnecessary sections.):

$$C_{\text{stock}} := 1 \cdot M$$

$$V_{\text{stock}} := 1 \cdot \text{mL}$$

$$V_{\text{total}} := 250 \cdot \text{mL}$$

$$C_{\text{acid}} := \frac{C_{\text{stock}} \cdot V_{\text{stock}}}{V_{\text{total}}}$$

$$C_{\text{acid}} = 4 \cdot 10^{-3} \cdot M$$

The concentration of the salt is:

$$\text{mass}_{\text{salt}} := 1.0 \cdot \text{gm}$$

$$\text{MW}_{\text{salt}} := ((22.990) + (12.001) + (2 \cdot 1.0079)) + (2 \cdot 15.999) \cdot \text{gm} \cdot \text{mole}^{-1}$$

$$\text{mole}_{\text{salt}} := \frac{\text{mass}_{\text{salt}}}{\text{MW}_{\text{salt}}}$$

$$\text{volume}_{\text{salt}} := 250 \cdot \text{mL}$$

$$C_{\text{salt}} := \frac{\text{mole}_{\text{salt}}}{\text{volume}_{\text{salt}}}$$

$$C_{\text{salt}} = 0.058 \cdot M$$



Equilibrium Concentrations (Calculated for both roots, select the reasonable answer [top or bottom in ()]):

$$\begin{array}{ll}
 C_{\text{HA}} := C_{\text{acid}} - X & C_{\text{HA}} = \begin{bmatrix} 3.988 \cdot 10^{-3} \\ 0.062 \end{bmatrix} \text{M} \\
 C_{\text{H}_3\text{O}^+} := X & C_{\text{H}_3\text{O}^+} = \begin{bmatrix} 1.238 \cdot 10^{-5} \\ -0.058 \end{bmatrix} \text{M} \\
 C_{\text{A}^-} := X & C_{\text{A}^-} = \begin{bmatrix} 1.238 \cdot 10^{-5} \\ -0.058 \end{bmatrix} \text{M} \\
 i := 0, 1..1 & \\
 \text{pH}_i := -\log(C_{\text{H}_3\text{O}^+_i} \cdot \text{M}^{-1}) & \text{pH} = \begin{bmatrix} 4.907 \\ 1.235 - 1.364i \end{bmatrix} \\
 \text{pOH} := 14 - \text{pH} & \text{pOH} = \begin{bmatrix} 9.093 \\ 12.765 + 1.364i \end{bmatrix}
 \end{array}$$