1. Calculate the relative amounts of HAc and Ac\(^-\) present at the following points when 1.0 mole of HAc is titrated with NaOH.

a. 1 mole NaOH added
   (OH\(^-\) converts HAc to Ac\(^-\))
   Final HAc = 1 - 1 = 0.9
   Final Ac\(^-\) = 0 + 1 = 1
   Ratio = 0.1 mole Ac\(^-\) : 0.9 mole HAc

b. 0.3 mole Ac\(^-\) : 0.7 mole HAc
   etcetera
2. Calculate the pH of a solution obtained by adding 0.0063 moles of Na$_2$HPO$_4$ and 0.01 moles of Na$_2$HPO$_4$ to 100 mL of pure water. The pK$_a$ of H$_2$PO$_4^-$ = 7.2

a. The acid is H$_2$PO$_4^-$, the salt is HPO$_4^{2-}$
(Note - The sodiums disappear when dissolved in water)

\[ \text{PH} = 7.2 + \log \frac{0.01 \text{ moles/L}}{0.0063 \text{ moles/L}} \]

\[ \text{This is the Answer.} \]

3. Calculate the pH of a solution obtained by:

3. Calculate the pH of the solution obtained when:

a. 1.0 mL of 0.1 M HCl is added to 99 mL of pure water

\[ 1.0 \text{ mL} = 0.001 \text{ L} \]
\[ 1 \text{ mol/L} \times 0.001 \text{ L} = 0.0001 \text{ moles HCl} = 0.0001 \text{ moles H}^+ \]
\[ 0.0001 \text{ moles H}^+ / 0.1 \text{ L} = 0.001 \text{ M H}^+ \]
\[ \text{PH} = -\log [0.001] = 3 \]

b. 1 mL of 0.1 M NaOH is added to 99 mL of pure water

\[ 1 \text{ mL} = 0.001 \text{ L} \]
\[ 1 \text{ mol/L} \times 0.001 \text{ L} = 0.0001 \text{ moles NaOH} = 0.0001 \text{ moles OH}^- \]
\[ \text{pOH} = -\log [0.0001] = 3 \]
\[ \text{pH} = 14 - \text{pOH} = 11 \]
4. Calculate the pH of the solution obtained by adding 1 mL of 1 M HCl to 100 mL of a buffer containing 0.0063 moles NaH₂PO₄ and 0.01 moles Na₂HPO₄.

1 mL 1 M HCl = 0.001 L x \( \frac{1 \text{ mole}}{1 \text{ L}} \) = 0.001 mole H⁺

Adding H⁺ converts HPO₄²⁻ to H₂PO₄⁻, so we lose HPO₄²⁻ by 0.001 moles and increase H₂PO₄⁻ by same.

Final pH = 7.2 + \( \log \frac{(0.01 - 0.0001)}{(0.0063 + 0.001)} / 1L \)