Chapter 11 - **Acid-Base Titrations**

Homework: Due Monday, March 2

Problems 11-2, 11-3, 11-6, 11-8, 11-12, 11-15, 11-19, 11-23, 11-37, 11-40, 11-42, 11-48, 11-54, 11-56

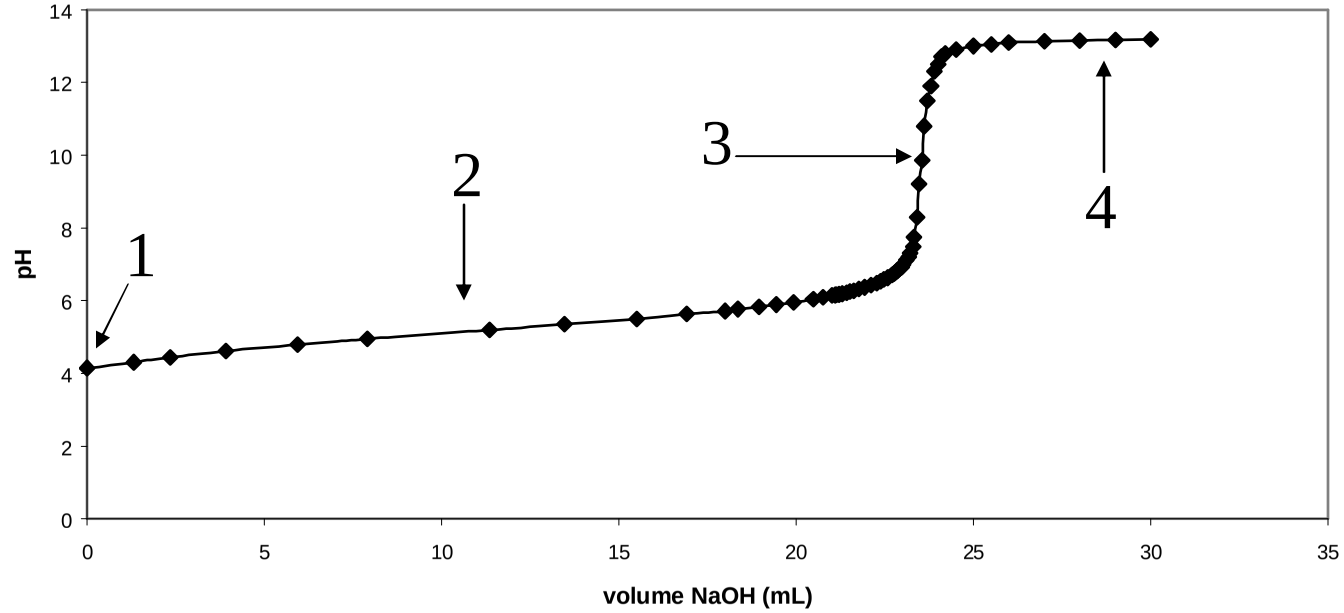
Titration of Acids & Bases

- Allows for the determination of the quantities of the acidic and basic components present in a mixture.
- Allows for the determination of the K_a's
- Provides some information about buffer capacities.
- Use the equations from Chapters 9 and 10 to construct titration curves.

Regions of the Titration Curve a Monoprotic Acid

Region 1: Initial point (no base added)
Region 2: Before equivalence point (buffer region)
Region 3: Equivalence point
Region 4: After equivalence point (excess base)

Titration Curve (weak acid titrated by strong base)



Determining pH of Different Regions of the Titration Curve a Monoprotic Weak Acid

The first step is to determine the volume of base needed to reach the equivalence point. Use the concentration and volume of acid.

Region 1: Initial point (no base added) – The pH is determined from the concentration of the weak acid. $x^2/(F-x) = K_a$ $x = [H^+]$

Region 2: Before equivalence point (buffer region) – The pH is determined using the Henderson-Hasselbalch equation (buffer)
pH = pKa + log([base]/[acid])

Region 3: Equivalence point – The pH is determined from the concentration of the weak acid (now converted to its conjugate base) and the dilution factor.

Region 4: After equivalence point (excess base) – The pH is determined from the concentration of excess $[OH^-]$ present.

Calculate the pH at each point for the titration of 100.0 mL of 0.100 M cocaine ($K_b = 2.6x10^{-6}$) with 0.200 M HNO_3. V_a = 0.0, 10.0, 20.0, 25.0, 30.0, 40.0, 49.9, 50.0, 50.1, 51.0, and 60.0 mL. Draw a graph of pH versus V_a.