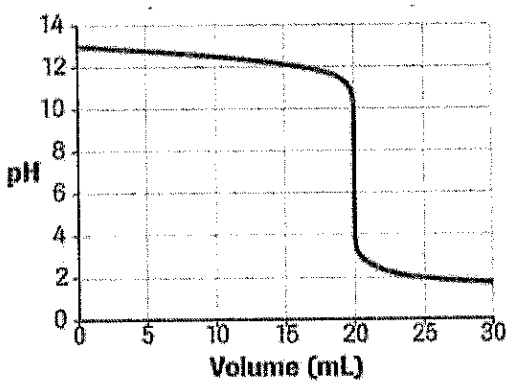
Graph 3



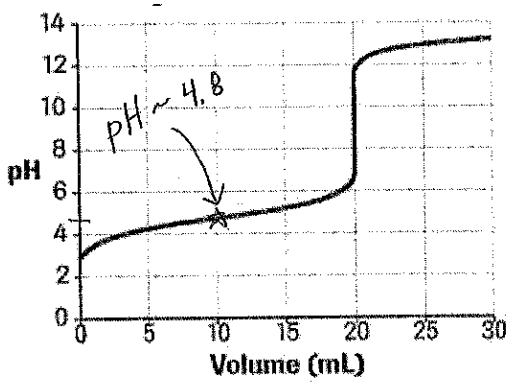
1) What type of titration? SB w/ SA

2) At the equivalence point, pH ≈ 7

3) If possible, determine the pK_a or pK_b of the analyte (and identify if your value is pK_a or pK_b).

n/a

Graph 4



1) What type of titration? WA w/ SB

2) At the equivalence point, pH ≈ 9

3) If possible, determine the pK_a or pK_b of the analyte (and identify if your value is pK_a or pK_b).

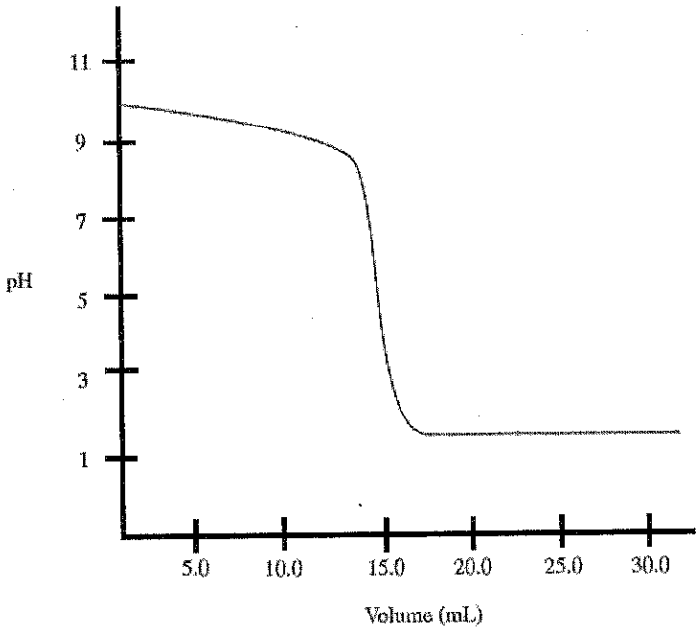
$pK_a = 4.5$

$K_a = 1 \times 10^{-4.5}$

Multiple Choice Practice

Use the following information to answer questions 1–5.

The following curve is obtained during the titration of 30.0 mL of 1.0 M NH_3, a weak base, with a strong acid.



1. Why is the solution acidic at equilibrium?

   a. The strong acid dissociates fully, leaving excess $[H^+]$ in solution.

   (b.) The conjugate acid of NH_3 is the only ion present at equilibrium.

   c. The water which is being created during the titration acts as an acid.

   d. The acid is diprotic, donating two protons for every unit dissociated.

2. What is the concentration of the acid?

a. 0.50 M b. 1.0 M c. 1.5 M (d.) 2.0 M

$M_a V_a = M_b V_b$

$x\,(15\,mL) = (1\,M)(30\,mL) \Rightarrow x = \frac{30}{15} = 2$

3. What ions are present in significant amounts during the buffer region?

(a.) NH_3 and NH_4^+ b. NH_3 and H^+ c. NH_4^+ and OH^- d. H_3O^+ and NH_3

4. Which volume on the titration curve corresponds with the region of maximum buffer efficacy? $\Rightarrow \frac{1}{2}$ eq. pt!

a. 0 mL (b) 7.5 mL c. 15 mL d. 22.5 mL

5. The titration is completed using an indicator which changes color at the exact equivalence point of the titration. The protonated form of the indicator is HIn, and the deprotonated form is In^-. At the equivalence point of the reaction:

(a.) $[HIn] = [In^-]$ b. $[HIn] = 1/[In^-]$ c. $[HIn] = 2[In^-]$ d. $[HIn] = [In^-]^2$

How to Sketch A Titration Curve

1. **Shape of curve**
   a. Acid titrated with a base (i.e. base added to acid, [acid] unknown): start low and end high pH
   b. Base titrated with an acid (i.e. acid added to base, [base] unknown): start high and end low pH
2. **Starting pH** (initial plateau)
   a. Starting pH < 7 if acid titrated with a base (usually pH < 4)
   b. Starting pH > 7 if base titrated with an acid (usually pH > 10)
3. **Equivalence point** volume **(mL):** steepest part (inflection point)
   a. Make sure you are using the volume of the solution being added (your titrant)
   b. Use $V_A M_A = V_B M_B$
4. **Equivalence point** pH
   a. Strong acid + strong base: pH = 7
   b. Strong acid + weak base: pH < 7
   c. Weak acid + strong base: pH > 7
5. **Ending pH** (final plateau)
   a. Ending pH > 7 if acid titrated with a base (usually pH > 10)
   b. Ending pH < 7 if base titrated with an acid (usually pH < 4)