Titration Curves

Weak Base-Strong Acid Titration Curves

- Before the addition.
- Construct an "equilibrium" reaction table ONLY!
- $K_b = \frac{[OH^-]\ [BH^+]}{[B]}$ and obtain $[OH^-]$.
- Calculate the pOH, then the pH.

Additions before the equivalence point.

- Construct a "stoichiometry" reaction table.
- Determine MOLES of *base* in excess (not neutralized) and MOLES of *conjugate acid* formed.
- Divide MOLES by the TOTAL VOLUME to obtain $[BH^+]$ and $[B]$.
- Construct an "equilibrium" reaction table.
- $K_b = \frac{[OH^-]\ [BH^+]}{[B]}$ and obtain $[OH^-]$.
- Calculate the pOH, then the pH.

Additions at the equivalence point

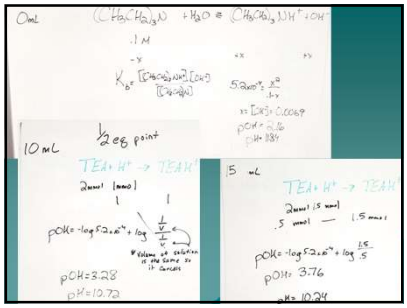
- Construct a "stoichiometry" reaction table.
- Determine MOLES of *conjugate acid* formed.
- Divide MOLES by the TOTAL VOLUME to obtain $[BH^+]$.
- Calculate K_a ($K_a \times K_b = K_w$).
- Construct an "equilibrium" reaction table, reacting the conjugate base with water.
- $K_a = \frac{[A^-]\ [H_3O^+]}{[HA]}$ and obtain $[H_3O^+]$.
- Calculate the pH.

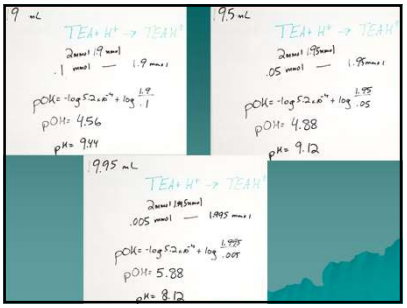
Additions beyond the equivalence point

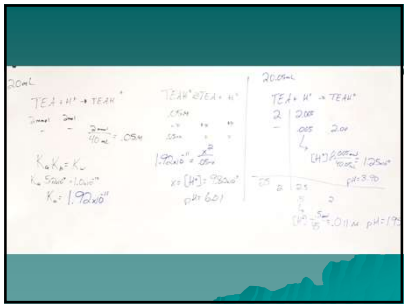
- Construct a "stoichiometry" reaction table.
- Determine MOLES of *acid* in excess (not neutralized) and the MOLES of *conjugate acid*.
- Divide MOLES by the TOTAL VOLUME,
- Because $[H_3O^+]_{excess} >> [H_3O^+]_{conj.\ acid}$, use $[OH^-]_{excess}$ to calculate the pH.

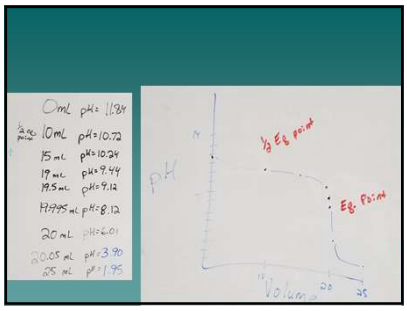
Problem

- 20.0 mL of 0.10 M triethylamine, $(CH_3CH_2)_3N$, ($K_b = 5.2 \times 10^{-4}$) are titrated with 0.100 M HCl. Calculate the pH after the additions of 0.0, 10.0, 15.0, 19.0, 19.5 mL, 19.95, 20.0, 20.05, and 25.0 mL samples of HCl.
- Then, construct a titration curve and label it properly.









Problem

- 50.0 mL of 0.10 M ammonia, NH_3, (K_b= 1.8 x 10^{-5}) are titrated with 0.10 M HNO_3.
- Calculate the pH after the additions of 0.0, 10.0, 25.0, 49.0, 49.95, 50.0, 50.05, 51.0 and 75.0 mL samples of HNO_3.
- Then, construct a titration curve and label it properly.

Answer

Volume	pH
0 mL	11.12
10 mL	9.85
25 mL	9.25
49 mL	7.56
49.95 mL	6.25
50 mL	5.28
50.05 mL	4.30
51 mL	3.00
75 mL	1.70