

NOTES #55 Titrations and Equilibrium

a. What is a titration? The process for determining the concentration of a solution using another solution of known concentration, called a standard solution. Remember chapter 4?

There are three types of acid base titrations:

- (1) Strong Acid/Strong Base (SA/SB)
- (2) Weak Acid/Strong Base (WA/SB)
- (3) Strong Acid/Weak Base (SA/WB)

I. Strong Acid/Strong Base Titrations:

a. We are going to titrate 50 mL of 0.10 M HCl with 0.10 M NaOH. Write the reaction.

As the NaOH is added, the pH of the solution _____. We are going to carry out pH calculations after adding various amounts of NaOH.

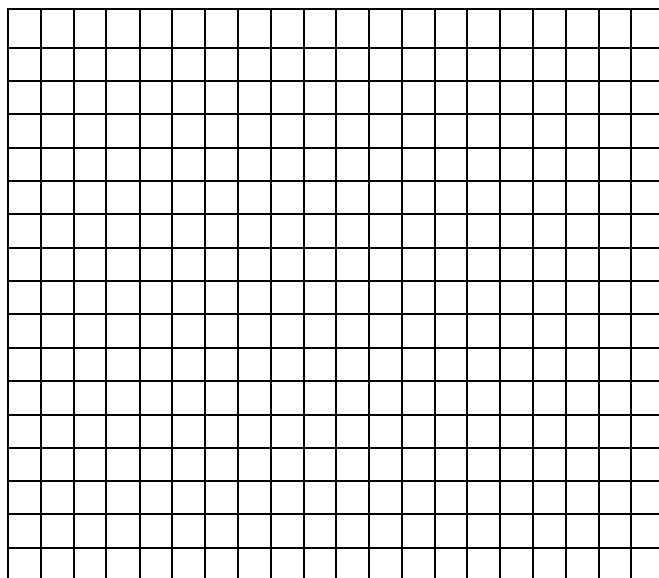
1. What is the initial pH of the acid solution?

2. What is the pH after the addition of 20 mL of 0.10 M NaOH to 50 mL of 0.10 M HCl?
* Prediction: Will the product mixture be acidic/basic or neutral? _____.

3. What is the pH after the addition of 50 mL of 0.10 M NaOH to 50.0 mL of 0.10 M HCl?
* Prediction: Will the product mixture be acidic/basic or neutral? _____.

4. What is the pH after the addition of 60 mL of 0.10 M NaOH to 50 mL of 0.10 M HCl?
* Predict: Will the product mixture be acidic/basic or neutral? _____.

pH



b. We can construct a Titration Curve for the titration of a SA/SB

Volume of NaOH

II. Weak Acid/ Strong Base Titrations:

a. Consider the neutralization reaction between acetic acid (a weak acid) and NaOH (strong base).

** What will happen to the CH_3COO^- ion in the solution _____.
This is different than the last example. Since we were dealing with a SA/SB, no ions hydrolyzed.
Show the hydrolysis reaction for the ion, CH_3COO^- .

b. How will the fact that a weak acid hydrolyzes affect the pH of the system at the equivalence point?

c. EX 1: Exactly 100 mL of 0.10 M nitrous acid is titrated with 0.10 M NaOH. Calculate the pH for (a) the initial solution, (b) the point at which 80 mL of the base has been added, (c) the equivalence point, (d) the point at which 105 mL of the base has been added.

d. A titration curve can also be drawn to illustrate a WA/SB system.

III. Strong Acid/ Weak Base Titrations:

a. Consider the titration of HCl, a strong acid, with NH_3 , a weak base:

b. Considering your products, what do you predict the pH will be at the equivalence point and why?

c. Draw a titration curve to represent a SA/WB titration.

d. Calculate the pH at the equivalence point when a 0.10 M NH_3 solution is titrated by a 0.10 M HCl solution.