Titration 3: NH_3 Titrated with HCl

Titration 1: Base is NH_3, Brom Blue in the indicator

1. Obtain about 60 mL of the standardized (≈ 0.1 M) HCl solution. **CAUTION:** *Avoid spilling it on your skin or clothing. Rinse with water if it comes in contact with skin or clothing.*

2. Obtain a 50-mL buret and rinse the buret with a few mL of the HCl solution. Fill the buret to above the 0.00-mL mark then drain to the 0.00-mL mark.

3. Obtain about 30 mL of the ≈ 0.1 M NH_3 solution. **CAUTION:** *Avoid spilling the acid on your skin or clothing. Rinse with water if it comes in contact with skin or clothing.*

4. Pipet 25.00 mL of the base solution into a clean, dry 250-mL beaker.
   - Add two to three drops of Brom Blue indicator.
   - Use a utility clamp to suspend the pH electrode on a ring stand as shown n Figure 1. Situate the pH electrode in the acid solution and adjust its position toward the outside of the beaker so that the stirring bar does not strike it.
   - Turn on the magnetic stirrer

5. Set up the PASCO software and hardware as directed in pre-lab. Make sure you can see the graph and table during the titration

6. Press the START button to begin recording and titrate until the end point is reached

Record the volume, pH and indicator color in your notebook.
• Continue adding HCl solution until the buret reaches the 50.00 ml mark. **Do not go below this mark!**

8. Press STOP to stop when you have finished collecting data. Examine the data points along the displayed graph of pH vs. time.

9. Print the graph as you will need it to complete this lab.

10. Continue with DATA ANALYSIS and POSTLAB

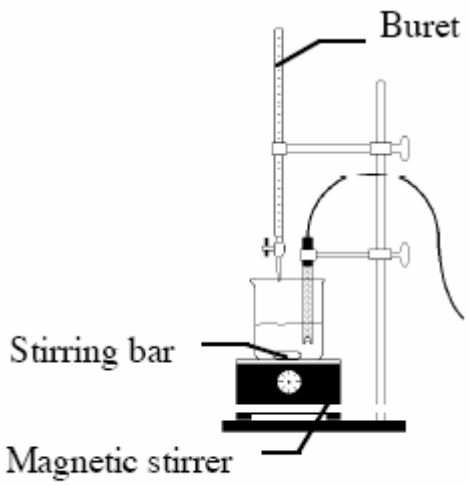

Figure 1

Clean-up
1. Collect all rinse, left over and titrated solutions in a 600-mL beaker and discard in the appropriately labeled waste container.

2. Rinse the pH electrode, place it back in its storage solution.

DATA ANALYSIS
Titration #3 NH_3 with HCl

Titration 4: NH_3 titrated with HCl

1. Using the titration curve, determine the equivalence volume of HCl and the pH at the equivalence point. **Clearly mark and label the equivalence point on the graph.**

Record the volume of HCl used to reach the equivalence point. _____

Record the pH at the equivalence point. _____

a) Is the pH equal to, above, or below 7.00 for this titration? Clearly explain what causes this to occur.

2. Using the equivalence volume of HCl and **precise molarity of HCl (see titration 1 results),** calculate the precise molarity of the ammonia solution we titrated.

Precise molarity of NH3 _____

Determination of Kb for ammonia. Three methods.

1. **From the initial pH:**

Using the pH of the ammonia before addition of any acid and the calculated concentration of the ammonia solution, determine Kb. (Look at the actual data in graphical analysis to get pH at 0.00 mL for this, do not just estimate it from your printed graph!) Determine and report the percent error in this value.

Calculated Kb from initial pH _____

Percent Error _____

2. From the pH at one-half the equivalence point volume:
Using your graph, determine the pH at one-half the equivalence volume. **Clearly mark and label this point on the graph.**

pH at one-half the equivalence volume _____

a. From the pH at one-half the equivalence volume, determine Kb for ammonia. (Careful here! What is the pH at half the equivalence point equal to? Determine and report the percent error in this value.

Kb from pH at half-equivalence point volume _____
Percent Error _____

b) **From the pH at the equivalence point:**
At the equivalence point all the ammonia has been neutralized. The solution now contains the product of the neutralization. From the pH at the equivalence point calculate Kb for ammonia. **Clearly show all work/steps in this calculation below.** Report the percent error in this value.

Kb for ammonia from equivalence point pH _____
Percent Error _____

3. Of your three Kb values which one is the most accurate?

4. Based upon our class results, is

b) phenolphthalein a good indicator for this titration?

c) bromthymol blue a good indicator for this titration?

Staple the graph to this paper