

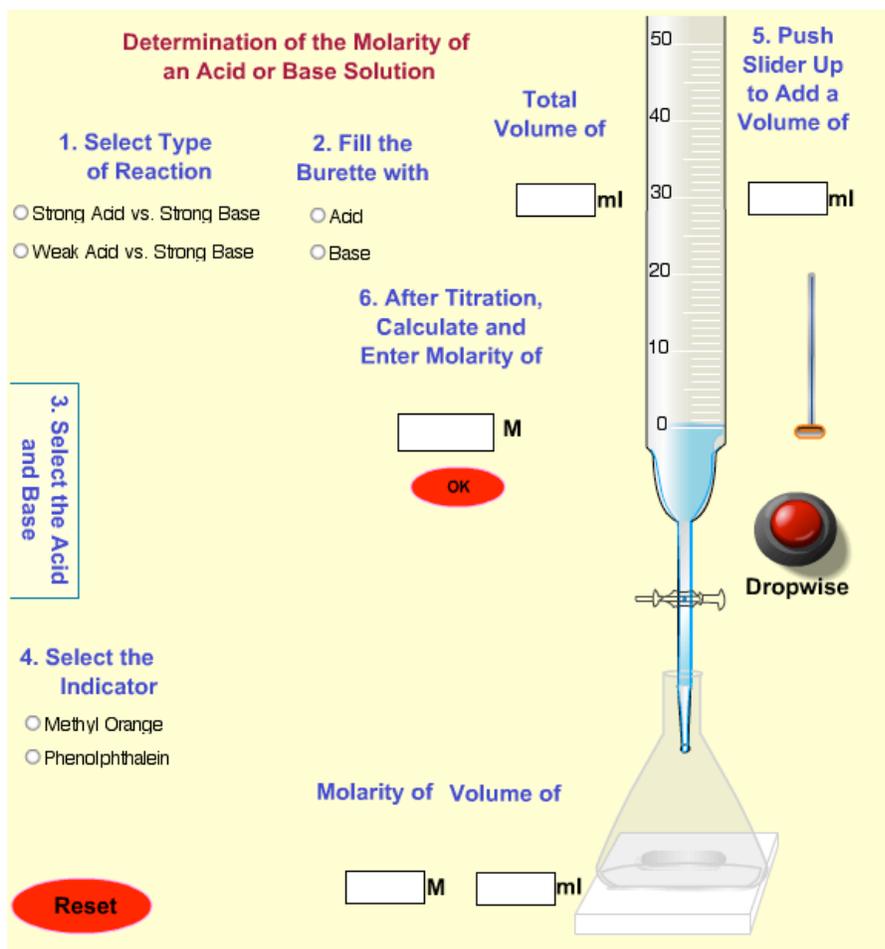
Acid/Base Titrations

Name _____ Lab Section _____

Problem Statement: How do acids and bases interact?

I. Data Collection:

A. Go to http://introchem.chem.okstate.edu/DCICLA/acid_base.swf to open the Acid/Base Titration Simulation. Your screen should look like the figure.



This simulation contains a titration apparatus. You can set up the conditions for a titration by following the step-by-step decisions in order by the numbers that are displayed in the simulation. As a trial: (1) select the strong acid vs. strong base reaction, (2) fill the burette with acid, (3) select HCl as your acid and KOH as your base, and (4) select bromothymol

blue as your indicator. Click on the slider bar that adds acid to the flask. (A new button labeled Concordant Values appears.) Then add acid in 5 mL increments until the color changes in the flask. You can add acid dropwise by using the Dropwise button. You can repeat the titration using the same conditions by clicking on the Concordant Values button.

- B. Reset the simulation. (1) Select the strong acid vs. strong base reaction, (2) fill the burette with acid, (3) select HCl as your acid and KOH as your base, and (4) select bromothymol blue as your indicator. Click on the slider bar that adds acid to the flask. Add acid in 5 mL increments until the color changes in the flask. Click on the Concordant Values button and re-enter the amount that was 5 mL less than the amount added that changed the color of the solution. Add the acid dropwise until one drop of acid just changes the color. Record the amount of added acid, the molarity of the base, and volume of the base in the table below. Calculate the molarity of the acid and enter the value in the provided space in the simulation. Check the accuracy of your calculation and then enter this value in the following table. Do not reset the simulation!

	Acid, HCl	Base, KOH
Volume (mL)		
Concentration (M)		

- C. Click on the Graph button and sketch the graph in the space below.

- D. Return to the titration apparatus. Click on the Concordant Values button and change the indicator to methyl red. Determine the amount of acid necessary to change the color of the solution. Enter the values in the table below. Do not reset the simulation!

	Acid, HCl	Base, KOH
Volume (mL)		
Concentration (M)		

- E. Click on the Concordant Values button and change the base to $\text{Ba}(\text{OH})_2$. Determine the amount of acid necessary to change the color of the solution. Enter the values in the table below.

	Acid, HCl	Base, $\text{Ba}(\text{OH})_2$
Volume (mL)		
Concentration (M)		

II. Data Analysis and Interpretation

- A. Finish writing the chemical equation representing the reaction between HCl and KOH from section I. B.



- B. Re-write the above equation as a net ionic equation.

C. Compare the amount of base necessary to react with HCl in sections I. B. and D.

D. Indicators change colors at different pH ranges. The two indicators available for this part of the experiment are in the following table with their pH ranges.

Acid/Base Indicator	pH Range	Color change
Methyl Red	4.8-6.0	Yellow to Red
Bromothymol Blue	6.0-7.6	Yellow to Blue

Considering the differences in the pH ranges of methyl red and bromothymol blue how do you account for the results of section I. B. and D. (Hint: use the plot in section I. C. in your explanation.

E. Compare the amount of base necessary to react with HCl in sections I. B. and E. How do you account for any differences you observe? Write chemical equations to illustrate your conclusions.

F. Predict what volume of acid would have been necessary to change the color of the base solution in section I. B. if H_2SO_4 had been used instead of HCl . Explain your answer.

G. Sketch the graph that you would have generated if you had filled the burette with base and had the acid in the flask in section I. B.

III. Data Collection:

A. Reset the simulation. (1) Select the weak acid vs. strong base reaction, (2) fill the burette with base, (3) select CH_3COOH as your acid and KOH as your base, and (4) select phenolphthalein as your indicator. Determine the amount of base necessary to change the color of the solution. Enter the values in the table below. Do not reset the simulation!

	Acid, CH_3COOH	Base, KOH
Volume (mL)		
Concentration (M)		

B. Click on the Graph button and sketch the graph in the space below.

IV. Data Analysis and Interpretation

- A. Write the chemical equation representing the reaction between CH_3COOH and KOH from section III. A.
- B. Compare the form of this equation with the equations you wrote for HCl and KOH in Sections II. A. and B.
- C. Compare the amount of base necessary to react with equal amounts of the same concentration of the strong acid HCl and the weak acid CH_3COOH .

D. Compare the graphs you sketched for section II. G. and III. B. Use the features of these graphs to illustrate the similarities and differences between strong acids and weak acids in a titration.