South Pasadena • AP Chemistry

Name _____
Period ___ Date ___/___/___

3 • Reactions in Aqueous Solution

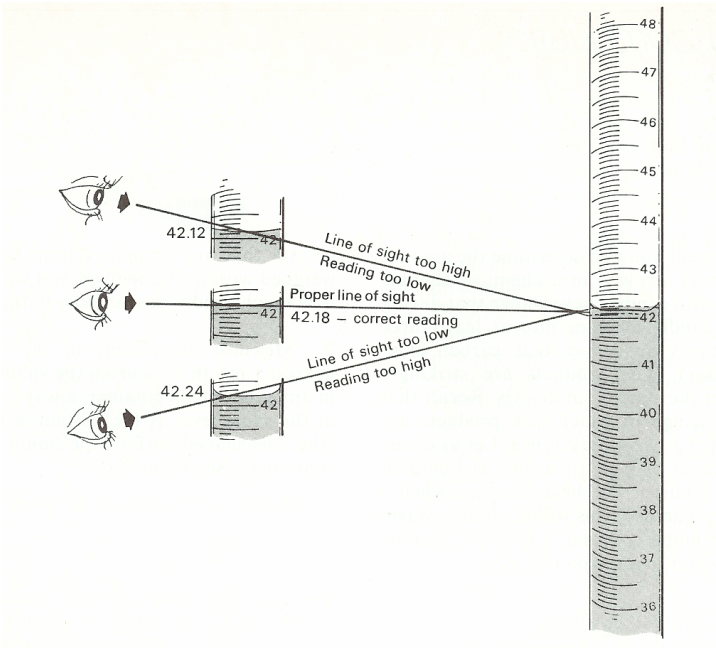
TITRATION LAB

Titration is the name given to the process for determining the volume of a solution needed to react with a given mass or volume of a sample. You will use this process to study quantitatively the reaction between an acid and a base. A common reaction in water is that of the hydrogen ion of an acid with the hydroxide ion of a base to form water. Phenolphthalein will be used as the indicator in this experiment since its color change occurs when the same number of moles of acid and base have been added. This point in the reaction is called the *end point*.

Overview

Using hydrochloric acid of known concentration, you will first standardize a sodium hydroxide solution—that is, determine its concentration expressed as moles per Liter. Using the standard base, you will then titrate a known volume of vinegar solution to determine its concentration.

Standardization of the solution of a base



1. Rinse and fill the buret at your station with base (NaOH) solution using the small beaker at your station. The base is located at _____.
2. Record the liquid level in the buret by reading the bottom of the meniscus to the nearest 0.1 mL.
3. Record the liquid level in the acid buret at the front of the room to the nearest 0.1 mL. Let about 10 mL of hydrochloric acid flow into a clean 250-mL Erlenmeyer flask. Record the final volume in the buret. Add about 15 mL of distilled water and 3 drops of phenolphthalein.
4. Hold the neck of the Erlenmeyer flask with one hand and manipulate the buret with the other. As you add the sodium hydroxide, gently swirl the flask so the solutions will mix. Continue adding sodium hydroxide until the first faint pink color develops. If the color disappears upon mixing the solution, add more sodium hydroxide, drop by drop, until a persistent pink color is obtained. (Take care not to go beyond the last calibration marks on the buret.) Record the liquid level at the bottom of the meniscus of the base buret. Rinse the Erlenmeyer flask thoroughly before repeating the titration.
5. Refill the base buret and perform at least one more titration. Repeat until you obtain ratios of volume of acid to volume of base that agree to 1 or 2 percent.

Titration of Vinegar

1. Refill the base buret and record the liquid level in the base buret.
2. Using the graduated cylinder, measure 10.0 mL of the diluted vinegar solution (10%) into a clean 250-mL Erlenmeyer flask. Add about 15 mL of distilled water and 3 drops of phenolphthalein.
3. Follow the directions above to titrate the vinegar sample.

Data—Standardization of Base

	Acid (HCl)	Base (NaOH)	Ratio: volume base / volume acid
Final volume (± .1 mL)			
Initial volume (± .1 mL)			
Volume			
	Acid (HCl)	Base (NaOH)	Ratio: volume base / volume acid
Final volume (± .1 mL)			
Initial volume (± .1 mL)			
Volume			
	Acid (HCl)	Base (NaOH)	Ratio: volume base / volume acid
Final volume (± .1 mL)			
Initial volume (± .1 mL)			
Volume			
	Acid (HCl)	Base (NaOH)	Ratio: volume base / volume acid
Final volume (± .1 mL)			
Initial volume (± .1 mL)			
Volume			

Data—Titration of Vinegar

	Vinegar	Base (NaOH)	Ratio: volume base / volume acid
Final volume (± .1 mL)			
Initial volume (± .1 mL)			
Volume			
	Vinegar	Base (NaOH)	Ratio: volume base / volume acid
Final volume (± .1 mL)			
Initial volume (± .1 mL)			
Volume			
	Vinegar	Base (NaOH)	Ratio: volume base / volume acid
Final volume (± .1 mL)			
Initial volume (± .1 mL)			
Volume			
	Vinegar	Base (NaOH)	Ratio: volume base / volume acid
Final volume (± .1 mL)			
Initial volume (± .1 mL)			
Volume			

Calculation:

1. Determine the concentration of NaOH knowing that the concentration of HCl is 0.150 *M*.

2. Determine the concentration of the diluted vinegar solution. Remembering that the solution is 10% vinegar, calculate the concentration of the original vinegar. It is listed as 5% acetic acid ($HC_2H_3O_2$) which should be 0.833 *M* $HC_2H_3O_2$.