# Acid / Base Titration
Chemistry

Name

OBJECTIVE: To use an indicator to find the concentrations of acids and bases.

INTRODUCTION

Acids and bases are useful in every aspect of everyday life. Acids are used in oil refinement, salad dressings, or beverage making; bases are used in soaps, chemical manufacture, and plant development.
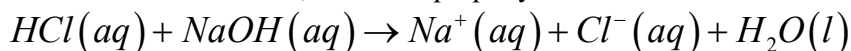
Often, we find the need as chemists to neutralize a base or acid. By this, we wish to convert acids and bases to water and salt:

$$acid + base \rightarrow salt + water$$
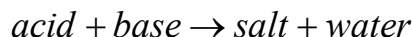
The textbook example of an acid/base neutralization is the reaction of hydrochloric acid, HCl, with sodium hydroxide, NaOH. This is a convenient reaction since HCl is a monoprotic acid, meaning the single proton nicely reacts with the hydroxide ion, forming water. HCl can easily be replaced with nitric acid, HNO_3, with a similar result. The reaction may be represented:

$$HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O(l).$$
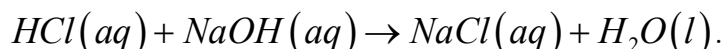
To emphasis the sodium and chloride ions, it is more properly written:

$$HCl(aq) + NaOH(aq) \rightarrow Na^+(aq) + Cl^-(aq) + H_2O(l)$$

In this lab, we will make a standard solution of NaOH, then titrate several unknown solutions of acids. From this information, we will find the concentrations of the acids.

MATERIALS

- burette
- ring stand
- burette clamp
- graduated cylinder

- 125mL Erlenmeyer flasks
- 250mL beaker
- funnel
- unknown acids

- NaOH
- 150mL beaker
- phenolphthalein solution

HAZARD WARNING
Strong acids and bases are corrosive to body tissue at the concentrations used in this lab. Handle all acids and bases with care and have a buffer nearby.

PROCEDURE

1   Using solid NaOH, prepare 200.mL of standard solution of 0.1M NaOH in water. Use this space for calculations.
     What is the theoretical amount of NaOH you should measure in grams? **Be precise.**

2   Clamp the burette to the ring stand, allowing some room between the burette and flask.
     Place a funnel into the top of the burette. Fill the buret anywhere below the top line with standard NaOH.
3   Obtain about 25mL of unknown acid. Record the formula and *exact* volume used. Place the unknown in a
     125mL Erlenmeyer flask. Put **one drop** of phenolphthalein solution in the flask and swirl (no reaction).
4   Place the unknown acid under the burette. Open the stopcock and allow the standard to flow into your test flask
     dropwise. One partner should operate the stopcock, and the other should be swirling the solution, careful not to
     bump the buret tip.
     *At the beginning of the titration, become familiar with the stopcock mechanism. When it points in the direction of
     the buret height, it is open. If it points perpendicular, it is closed.*
5   At the first sign of the endpoint, slow your rate almost to the point of stopping. Once the solution has become
     slightly pink, the titration is complete. Record the final height of the buret.
6   Refill the buret with standard solution. Repeat steps 3-6 for other unknowns.
7   Wash the funnel. Remove the buret from the stand. Wash and rinse out the buret thoroughly using a clean beaker
     to transfer water. Perform a final vinegar rinse. Leave it inverted on the stand to dry.

DATA/OBSERVATIONS

Trial	Unknown Acid Volume (mL)	V_i (mL)	V_f (mL)
1			
2			
3			
4			
5			

Base Standard Molarity
This is based on your measurement in grams. Show work.

Mass NaOH: _____ *g*

M_{base} = _____ **M**

ANALYSIS

Calculate the molarity of the unknown acids using the formula $M_1V_1 = M_2V_2$. Show one sample calculation in the box to the right; fill in the table for the rest of the calculations.

Trial	M_{acid}	V_{acid}	M_{base}	V_{base}
1				
2				
3				
4				
5				

Sample Calculation

POST-LAB QUESTIONS

1.   What is an endpoint of titration? What chemical was used to indicate this? And what was the indication?

2.   Why was a buret used in this exercise instead of a graduated cylinder to measure volume?

3.   Turmeric is a well-known spice. Would this work well as an indicator in this lab? Research and briefly explain.