**Detection of Ions in Solutions Using Acid/Base Chemistry: Standardization of NaOH using KHP**

Objective: This lab focuses on the detection of ions using titration as an analysis tool. You will learn to prepare samples of a specified concentration, learn about acids and bases through the use of titrations and learn how to detect endpoints using different indicators.

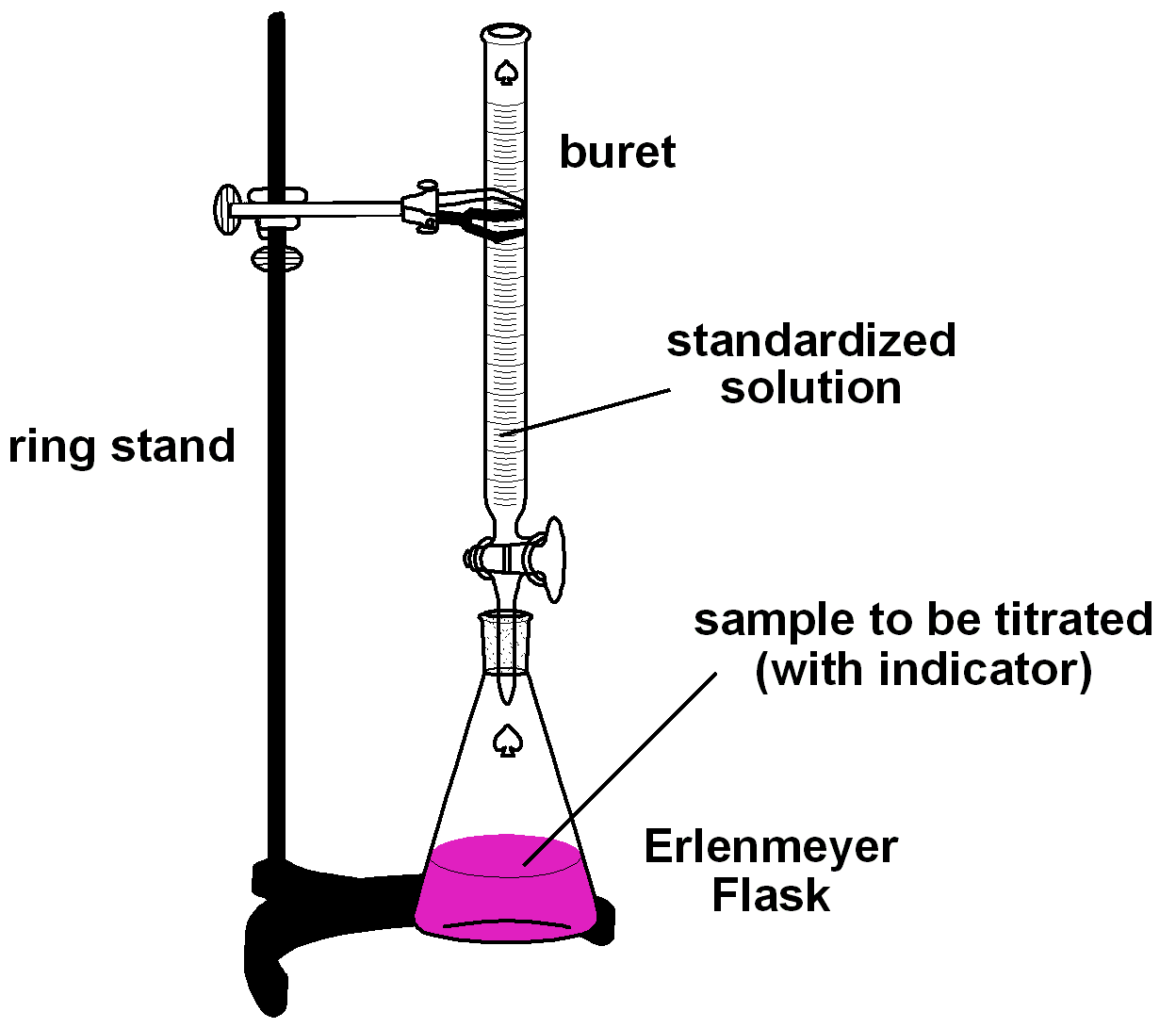
**What is a Titration?**

A titration is an analytical procedure used to determine the concentration of a sample by reacting it with a standard solution. One type of titration uses a neutralization reaction, in which an acid and a base react to produce a salt and water.

Neutralization%20Reaction

In equation 1, the acid is HCl (called hydrochloric acid) and the base is NaOH (called sodium hydroxide). When the acid and base react, they form NaCl (sodium chloride), which is also known as table salt. The titration proceeds until the equivalence point is reached, where the number of moles of acid is equal to the number of moles of base. This point is usually marked by observing a color change in an added indicator.

In a titration, the standard solution goes in a buret, which is a piece of glassware used to measure the volume of solvent to approximately 0.1 mL of accuracy. The solution that you are titrating goes in an Erlenmeyer flask, which should be large enough to accommodate both your sample and the standard solution you are adding.



**Standardizing a Sodium Hydroxide (NaOH) Solution**

In a titration, it is critical to know the exact concentration of the titrant (the solution in the buret which will be added to the unknown) in order to determine the concentration of the solution being tested. We will standardize the ~0.1 M NaOH solution (the titrant) with potassium hydrogen phthalate (KHP, KC8H4O4H) using phenolphthalein as the indicator. KHP is a weak acid and reacts with base in the following way:

standard%20NaOH%20reaction

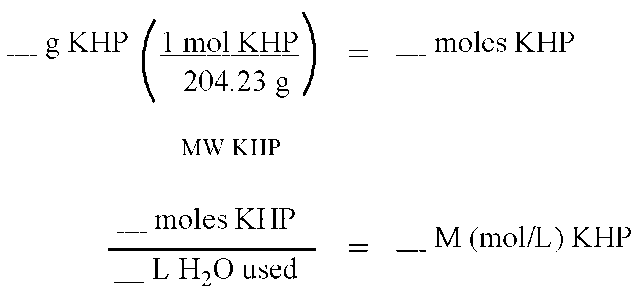
**Pre-lab question:**

Calculate the molarity of a solution of sodium hydroxide, NaOH, if 23.65 mL of this solution is needed to neutralize 0.5632 g of potassium hydrogen phthalate (KHP).

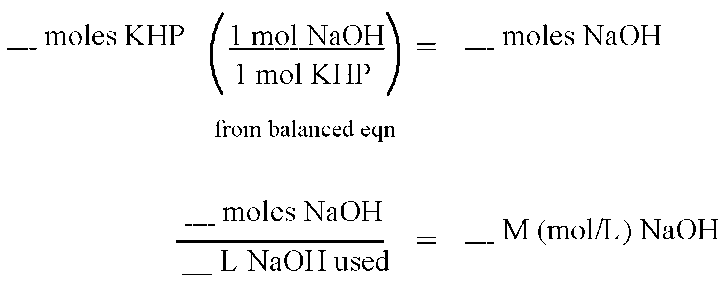
**To Standardize:**

1. Weigh ~0.8 g of dried KHP (MW = 204.23 g/mol) into an Erlenmeyer flask and dissolve in 50-75 mL of distilled water. Record the amount of KHP and water used.
2. Add 4 drops of indicator into the flask and titrate to the first permanent appearance of pink. Near the endpoint, add the NaOH dropwise to determine the total volume most accurately.
3. Calculate the concentration of NaOH in the following way:

Calculate Concentration of KHP:



Calculate Concentration of NaOH:



**Remember: There are 1000 mL in a L and 1000 mg in a gram.**

1. Report the concentration of NaOH to the class. An average number will be determined to give the most reliable value of NaOH concentration.