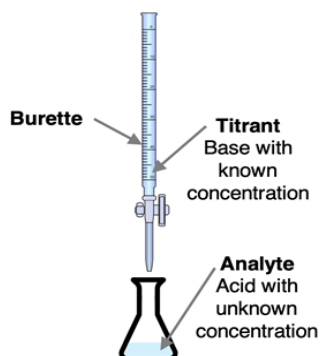


Titrations

Read from Lesson 4c: [Titrations](#) in the Chemistry Tutorial Section, Chapter 15 of The Physics Classroom

Titrations in the Chemistry Lab



- Titration: Analytical method to determine unknown concentration (analyte) using a known solution (titrant).
- Titrations rely on neutralization stoichiometry and precise volume measurements.

Equivalence Point vs. Endpoint

- **Equivalence Point:** Stoichiometric balance (acid = base).
- **Endpoint:** Indicator changes color—should closely match the equivalence point.



Equivalence Point

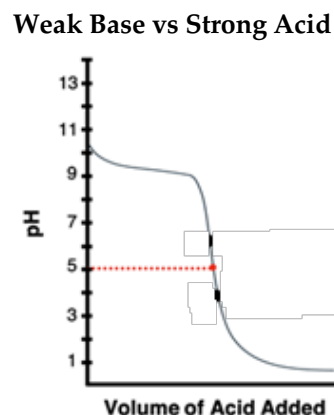
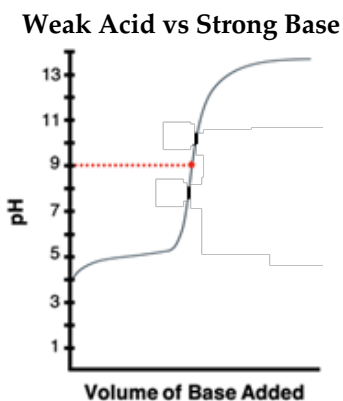
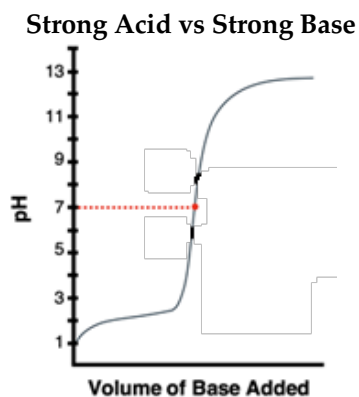
- Equal moles of acid and base



Endpoint

- Indicator changes color

Titration Curve Comparison



Indicator Selection

Titration Type	pH at Equivalence	Best Indicator	Color Change Range
Strong Acid + Strong Base	= 7.0	Bromothymol Blue	6.0–7.4
Weak Acid + Strong Base	> 7.0	Phenolphthalein	8.0–10.0
Weak Base + Strong Acid	< 7.0	Methyl Red	4.0–6.0

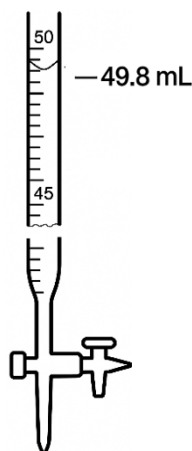
Acids and Bases

Questions

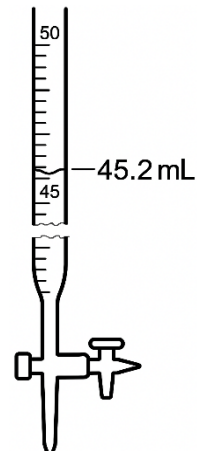
1. During an acid base neutralization reaction, LiOH solution from a burette is used to neutralize a HBr solution.

- a. Use the burette images to determine the volume of lithium hydroxide used:
- _____

Initial burette reading:

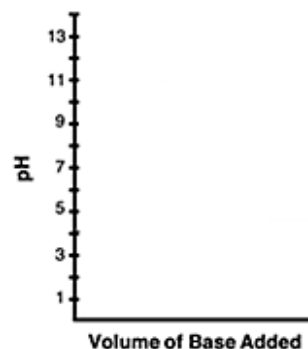


Final burette reading:



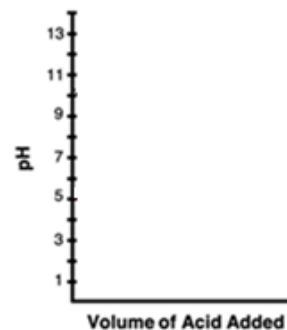
- b. If 17.20 mL of 0.250 M HBr was neutralized, determine the molarity of the lithium hydroxide solution used.

- c. In the space provided, sketch the titration curve. Predict and label the approximate pH at the equivalence point for this reaction.



2. Molly Cule and Aaron Agin are doing a titration of a weak base with a strong acid.

- a. In the space provided, sketch the titration curve. Predict and label the approximate pH at the equivalence point for this reaction.



Acids and Bases

- b. Molly and Aaron must choose an appropriate pH indicator to help them to determine when the titration has reached its endpoint. Molly wants to use methyl red.; Aaron prefers phenolphthalein. Who is correct? Justify your answer.
- c. Molly and Aaron continue the titration. They titrate 35.00 mL of ammonia (NH_3) with 0.367 M HCl. The endpoint is reached after adding 47.80 mL of acid. Determine the molarity of the ammonia solution.
3. A food chemist is analyzing a 50.0-gram sample of fruit spread to determine its benzoic acid ($\text{HC}_7\text{H}_5\text{O}_2$) content. She performs a titration using a 0.100 M standardized NaOH solution, and the endpoint is reached after 25.17 mL of NaOH has been added.
- Calculate the number of moles of NaOH added to the sample.
 - Determine the number of moles of benzoic acid originally present in the fruit spread.
 - Calculate the mass of benzoic acid present in the sample.
 - Determine the percent by mass of benzoic acid in the fruit spread.

