

Supervisor: Assis. Prof. Dr. Mohammed A. B. Abdul Jabar

Lab -5-

Titration Strong Acid with Strong Base

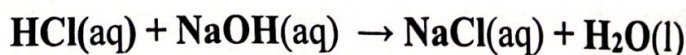
1. Introduction:

- **Standard solution:** The solution of accurately known concentration.
- **A titration:** Titration involves the addition of a solution whose concentration is known to a solution whose concentration is unknown. The volume of the known solution required to react completely with a known volume of the solution whose concentration is to be determined is measured. An indicator is added to the solution to mark the point at which the two quantities reach equivalence.
- **Phenolphthalein** is the indicator usually used in a reaction of strong acid with a strong base. Phenolphthalein is colorless in acid solutions and pink (red) in basic solutions with a pH range between 8.2-10.

Indicator	pH Range	Acid	Base
Thymol Blue	1.2-2.8	red	yellow
2,4-Dinitrophenol	2.4-4.0	colorless	yellow
Methyl yellow	2.9-4.0	red	yellow
Methyl orange	3.1-4.4	red	orange
Bromphenol blue	3.0-4.6	yellow	blue-violet
Methyl red	4.4-6.2	red	yellow
p-Nitrophenol	5.0-7.0	colorless	yellow
Phenol red	6.4-8.0	yellow	red
Thymol blue	8.0-9.6	yellow	blue
Phenolphthalein	8.0-10.0	colorless	red
Alizarin yellow	10.0-12.0	yellow	lilac
Salicyl yellow	10.0-12.0	yellow	orange-brown
Trinitrobenzoic acid	12.0-13.4	colorless	orange-red

Types of Titration:

- 1- Neutralization (reaction of acid with base.).
- 2- Precipitation reaction.
- 3- Oxidation – reduction reactions
- 4- Complex formation reactions

The reaction of strong acid/strong base

2. **Objective:** To determine the molarity of an unknown concentration of HCL.

3. **Materials:**

Ring stand, 1 Erlenmeyer flask, phenolphthalein, Buret, DI water, 0.5 NaOH, double buret
Clamp, unknown acid, 2 beakers funnel

4. **Procedure:**

1. Set up the ring stand, buret, and double buret clamp. Make sure that the buret remains vertical at all times.
2. Add some DI water to the buret to check for leaks. If there are no leaks, drain the DI water completely from.
3. Carefully add the HCl to the buret. You will need to drain some of the HCl from the buret to fill the tip. Fill the buret so that the meniscus of the HCl is sitting on the 0.00 mL mark with the tip filled.
4. Using the graduated cylinder add about 10 mL of DI water to a 250 mL Erlenmeyer flask.
5. Add exactly 10 mL NaOH to the water in the Erlenmeyer flask.
6. Add 2 – 3 drops of phenolphthalein to the Base solution in the Erlenmeyer flask.
7. Place the Erlenmeyer under the buret. Place a sheet of white paper under the Erlenmeyer.
8. You are now ready to begin titrating. Carefully add about 1 mL of the unknown acid HCl from the buret to the Erlenmeyer flask and swirl to mix. Continue adding 1 mL increments until you begin to see a pink color. The pink color should appear briefly and then quickly disappear. Be careful not to splash on the sides of the flask. If you do, you can add a small amount of DI water to your flask. As you near the endpoint, the pink color should stay longer, but will still disappear when the flask is swirled.
9. Clean out the Erlenmeyer flask and repeat steps 2 – 3 times more. The solution in the Erlenmeyer can be poured down the drain. Before you start the third trial, make sure that you have enough HCl in the buret to complete the titration (use your values from the first and second trials to estimate the amount needed for the third trial).
10. Clean out the Erlenmeyer and dispose of any remaining acid or base by mixing together to neutralization, turn on the water, and drain into the sink.

5. **Calculation:**

$M_{\text{acid}} = \text{Molarity of acid} = \underline{\hspace{2cm}} \text{ M}$

$V_{\text{acid}} = \text{Volume of acid} = \underline{\hspace{2cm}} \text{ mL}$

$M_{\text{base}} = \text{Molarity of base} = \underline{\hspace{2cm}} \text{ M}$

$V_{\text{base}} = \text{Volume of base} = \underline{\hspace{2cm}} \text{ mL}$

$\text{moles} = (\text{moles/liter}) \times \text{liters} = MV$

$$(M_1 \cdot V_1)_{\text{acid}} = (M_2 \cdot V_2)_{\text{base}}$$