Al-Karkh University of Science
College of science
First year level
General chemistry Labs

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# 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 know a solution whose concentration is unknown. The volume of the known solution requ to react completely with a known volume of the solution whose concentration is b determined is measured. An indicator is added to the solution to mark the point at w the two quantities reach equivalence.
- **Phenolphthalein** is the indicator usually used in a reaction of strong acid with a st base. Phenolphthalein is colorless in acid solutions and pink (red) in basic solutions 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**

$$HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O(l)$$

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**:
$M_{acid}$ = Molarity of acid = _____ M
$V_{acid}$ = Volume of acid = _____ mL
$M_{base}$ = Molarity of base = _____ M
$V_{base}$ = Volume of base = _____ mL
moles = (moles/liter) x liters = MV

$$(M_1.V_1)_{acid} = (M_2.V_2)_{base}$$