

Acid-Base Titration

Procedure

Part1: Determination of Molarity of Hydrochloric -Acid Solution

1. Put on your safety goggles
2. Obtain 50ml of HCl of unknown concentration and 100ml of the standardized NaOH solution. Record the molarity of the NaOH in your data table.
3. Obtain and rinse well with tap water a 50ml buret and a 25ml pipet. The buret will be used to measure sodium hydroxide and the pipet will be used to measure hydrochloric acid solution.
4. Rinse your pipet with a small amount of HCl
5. Using a suction bulb, pipet 10.0 ml of the HCl solution into a clean 250mL Erlenmeyer flask.
6. Add 3 drops of phenolphthalein to the solution in the flask.
7. Rinse a clean buret with approximately 15 mL of the standardized NaOH solution. Drain the buret and refill with standardized NaOH solution. Record the initial volume of the NaOH in the buret in your data table.
8. Adjust the height of the buret until the tip is inside the neck of the flask. Gradually add NaOH solution from the buret with constant swirling of the solution until the pinkish colour appears and dissipates. When the colour starts to fade more slowly, the equivalence point is approaching. Now, add the NaOH drop by drop. Stop the titration when the addition of a single drop causes the solution to remain pinkish for about 15-30s. This is the endpoint of the titration and the equivalence point.

NOTE: The NaOH solution may be added rapidly at first causing a pink colouration which can rapidly disappear as the solution is swirled. As the endpoint is approached, this colouration will become more persistent and the NaOH should be added more slowly, finally drop by drop when the endpoint is actually reached. As each drop is added, the tip should be touched to the side of the flask to remove any adhering solution. This procedure allows even half drops to be added.

9. Record the volume of NaOH needed to reach the equivalence point. The most accurate reading is one in which the solution is the faintest possible pink but still remaining that colour. Record the volume of NaOH used for the titration by subtracting initial and final volumes of NaOH. This is called the titre for the titration.

10. Repeat steps 5-9 using a second 10.0 mL sample of the HCl. Knowing the volume obtained in your first titration, you should be extra careful when you are within 1 mL of the previous value and add the NaOH dropwise, shaking after each drop.
11. It is necessary to repeat this procedure until you obtain two titres that agree to within 0.10mL. These do not have to be consecutive trials.
12. Clean all glassware with tap water, especially rinse well the buret and pipet or these will become plugged upon drying by the chemicals these contained.

Part II: Determination of Percentage Composition of Vinegar

1. Obtain 30 mL of white vinegar (acetic acid solution)
2. Using the same buret of NaOH as was used in Part I, do more titrations using 10.0 mL portions of the vinegar instead of the HCl. Follow the exact same procedure as in Part I. Record your observations in Table 2.

Data and Observations

Table 1: Volume of NaOH Needed to Neutralize 10.00 mL of HCl

Molarity of NaOH =	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7
Initial volume of NaOH (mL)							
Final volume of NaOH (mL)							
Volume of NaOH used							
Average volume of NaOH							

Table 2: Volume of NaOH Needed to Neutralize 10.00 mL of Vinegar

Molarity of NaOH =	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Trial 7
Initial volume of NaOH (mL)							
Final volume of NaOH (mL)							
Volume of NaOH used							
Average volume of NaOH							

Calculations:

1. Calculate the moles of NaOH used in the experiment.
2. Calculate the moles of HCl present originally.
3. Calculate the molarity of the HCl solution.
4. Calculate the moles of NaOH used in Part II.
5. Calculate the moles of acetic acid present originally.
6. Calculate the molarity of the acetic acid solution
7. Calculate the mass of acetic acid in 1L of solution.
8. Calculate the percentage of acetic acid in the vinegar.

Follow –Up Questions:

1. What was the reason for rinsing out the buret with NaOH solution before starting the titration?
2. By law, vinegar must be not less than 4% by mass acetic acid. Did your sample meet this specification?