Kevin Zhang Lab Report 7

Introduction

In this lab, we will be titrating an acidic unknown in order to determine its concentration. This can be computed from the volume of base added, and calculating how much of the acid would react with that much base.

Chemical Responsibility

Strong bases and acids are used in this lab. Both HCl and NaOH are toxic and corrosive, and easily absorbed through the skin. Acetic acid also causes skin burns.

Report Sheet

Molarity of Standard HCl Solution: 0.10 M

Unknown No: F

Standardization of NaOH (using HCl)

Trial #	HCl (mL)	NaOH (mL)	[NaOH]
1	22.9	24.4	0.0939
2	23.6	23.8	0.0992
3	22.5	22.2	0.101
Avg	--	--	0.0980

Titration of Acetic Unknown

Trial #	Unknown (mL)	NaOH (mL)	[Unknown]
1	24.5	35.4	0.1416
2	20.0	29.0	0.1421
3	20.5	29.0	0.1386
Avg	--	--	0.1408

Sample Calculations

$$[NaOH] = \frac{22.9 \text{ mL HCl} \times 0.1 \frac{\text{mol HCl}}{1000mL} \times \frac{1 \text{ mol NaOH}}{1 \text{ mol HCl}}}{24.4 \text{ mL NaOH} \times \frac{1L}{1000mL}} = 0.0939M$$

$$[\text{Unknown}] = \frac{35.4 \text{ mL NaOH} \times 0.98 \frac{\text{mol NaOH}}{1000mL} \times \frac{1 \text{ mol Unknown}}{1 \text{ mol NaOH}}}{24.4 \text{ mL Unknown} \times \frac{1L}{1000mL}} = 0.1416M$$

Discussion of Results

The results indicate that the concentration of the unknown F is approximately 0.1416. As we don't actually know the original concentration, there's no way to gauge the accuracy of this calculation. The molarity of the NaOH was 0.0980 M, which is very close to the intended 0.10 M concentration we were hoping to achieve.

Post-Lab Questions

1. Define equivalence point. The equivalence point is exactly the point in a titration at which all of the acid/base has been consumed by the base/acid (respectively), and adding any more base/acid is in excess.
2. What is an indicator? An indicator is a substance that changes color in different pH levels.
3. Why does phenolphathalein turn pink in the titrations you performed? Phenolphathalein is a basic indicator, meaning that it goes from colorless to pink at a pH level above ~8. In this case, because we are titrating a weak acid (acetic) with a strong base (NaOH), the color changes when the solution becomes basic.
4. Why is it necessary to experimentally determine the molarity of NaOH used instead of just using the value calculated by dilution? In our case, the NaOH was roughly diluted -- we measured out approximately 475 mL of water and combined it with 25 mL of 2.0 M NaOH. But, it was also important to determine the molarity because NaOH reacts with the air and glass bottle used to store them. Thus, the concentration might change from one experiment to the next, and experimentally determining this value ensures accuracy.
5. Write balanced net ionic equation for acetic acid + sodium hyrodroxide.

$$H^+ + OH^- \longrightarrow H_2O$$

6. What is meant by the term "back titrate"? Back titration is adding in some extra amount of original solution into the titrated mixture. This is so that if the experiment goes too far (too much NaOH added), the experiment can be reversed to some extent.

7. Why should one rinse a buret with the solution that is ultimately to be placed in the buret? The buret is a very precise instrument, so trace amounts of water left behind can affect the concentration of the solution via dilution. By rinsing the buret with the solution, the concentration stays the same
8. What is the concentration of NaOH solution prepared by diluting 25 mL of 1.975 M NaOH into final volume of 500 mL?

$$[NaOH] = \frac{25mL \times 1.975M}{500mL} = 0.09875M$$

Conclusion

And that is how you determine the concentration of an acidic unknown.