Name: _____

Lab 22. Quantitative Analysis: Titration

Materials

- KOH titrant solution of known concentration
- HCl, H_2SO_4, NaOAc, and NaOH solutions of unknown concentration
- Sodium acetate solution of unknown concentration
- Wash bottle of distilled water
- Volumetric pipet
- Pipet filler pump
- Phenolphthalein indicator solution
- Small Erlenmeyer flask (titration flask)
- Beral pipet
- Waste beaker
- Funnel

Procedure

A titration

1. If the buret is clean and dry, you may fill it with titrant solution. Open the stopcock and let the titrant run out until all air bubbles have been swept out of the buret's stopcock and tip.
2. If the buret contains traces of anything other than the titrant solution, rinse it with the titrant solution. Use a beral pipet to rinse down the inside of the buret and allow it to drain. Rinse the buret at least twice before filling it with titrant solution and running out the air bubbles.
3. Transfer a known volume of the unknown analyte solution into an Erlenmeyer flask using a volumetric pipet. Draw the solution into the pipet so that the bottom of the meniscus is even with the mark on the stem of the pipet and allow the liquid to drain out under gravity. Do not blow the last bit of liquid out of the pipet.
4. Add a drop of indicator solution to the analyte in the flask. Swirl the flask to mix.
5 .Read and record the starting position of the meniscus of the titrant solution in the buret.
6. Dispense titrant into the analyte flask. Swirl the flask constantly to ensure rapid and effective mixing. When you get close to the color change, add the titrant solution to the analyte *very* slowly. The change will be abrupt, and you don't want to overshoot it! If you do overshoot, record it as a rough titration and start over.

7. The indicator color will change at the endpoint. The ideal titration endpoint is a faint or intermediate color: for phenolphthalein indicator, this means just barely pink.
8. Read and record the final position of the bottom of the meniscus of the titrant solution in the buret. The difference between the final and starting positions is the volume of titrant solution dispensed.

What to titrate

1. Use the known KOH titrant solution to titrate the HCl solution to find its molarity.
2. Use the known HOH titration to titrate the H_2SO_4 solution to find its normality.
3. Use either no-known acid solution to titrate the NaOAc solution to find its molarity.
4. Use either now-known acid solution to titrate the NaOH solution to find its molarity.

When you are confident that you can perform a titration expertly, call me over to watch you. I will ~~judge~~ grade you.

Calculation

1. Subtract the starting meniscus reading from the ending meniscus reading for a titration to find the volume *V* of titrant dispensed. Enter this value into the Calculations Table.
2. Use the relationship $n = cV$ to find *n*, the moles of titrant dispensed, from *c*, the titrant concentration, and *V*.
3. Use the relationship $c = n/V$ to find the normality *c* of the analyte solution. The *n* to use here is the number of moles of H^+ or OH^- that were dispensed with the titrant. This will be the same as the moles of titrant dispensed if the titrant releases only one H^+ or OH^- per molecule. This formula finds the normality of the analyte and not necessarily its molarity because a single molecule of analyte may release more than one H^+ or OH^- ion.

Grading

Each student should perform a titration of the unknown HCl and H_2SO_4 analyte solutions. Each partnered pair should additionally titrate the NaOAc and NaOH analyte solutions, with one partner titrating one of the analytes and the other partner titrating the other analyte.

Data table	10
Calculation table	5
Witnessed titration	5
Lab technique, demeanor, and safety	10

Data Table

Label	Titrant	Conc	Analyte	Volume	Operator	Titrant level	
						Start	Finish

Calculation Table

Label	Volume of titrant	Moles of titrant	Normality of analyte