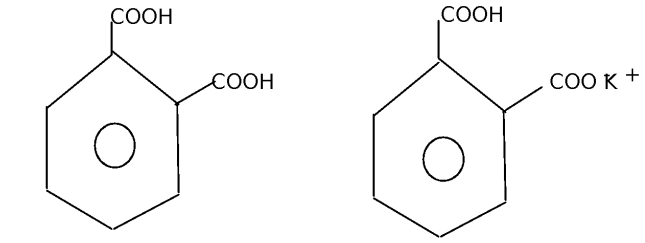
Percentage of Acetic Acid in Vinegar

A. Standardization of Sodium Hydroxide solution (DAY 1)

Sodium hydroxide is not a primary standard. By this we mean that it cannot be massed out accurately-- it rapidly absorbs an unknown amount of water from the atmosphere. If left exposed to the air, it will rapidly turn into a viscous semi-solid by gaining water from the environment.

You will be given a premade NaOH solution that is presumed to be *near* 0.25M, but it is impossible to know the exact mass of sodium hydroxide used in making it. Your solution concentration will be close to 0.25M but you need to know exactly what its concentration is to 3 significant figures.

To accurately determine the concentration of your sodium hydroxide solution, you must titrate it against a primary standard. One of the most common primary standards is potassium hydrogen phthalate (abbreviated KHPh). Potassium hydrogen phthalate is a primary standard--it can be prepared in pure form and weighed accurately.



Phthalic Acid (diprotic)

Potassium Hydrogen Phthalate (monoprotic)

You will be working in pairs or on your own only…NO TRIOS ALLOWED!

At your station, you should have a burette, 50ml beaker, larger waste beaker, 250ml Erlenmeyer flask, and your NaOH stock flask.

-Wash a 250ml Erlenmeyer flask. Rinse with distilled water. Prepare a burette with the sodium hydroxide solution to be standardized, as shown in class and in the training videos:

- -pour a small amount of distilled water into your buret, filling about a ¼ to a 1/3 while rotating it
- -open the stopcock to let the water drain, then close it.
- -clean and dry your 50ml beaker with soap and tap water, then rinse with distilled water and dry it
- -pour some NaOH into the 50ml beaker
- -pour a small amount of NaOH into your buret, filling about a ¼ to a 1/3
- -open the stopcock to let some drain into the waste beaker for a moment, then close it.
- -empty the buret through the open end while turning it to coat the entire surface with the base.
- -repeat the process again with a smaller amount of base,
- -completely fill the buret a little PAST the top line
- -Using waste beaker, drain the base into it until the volume in the buret is below the zero line

-Come up to me and get a sample of KHPh. Weight it on its weighing paper, add to the Erlenmeyer flask. Mass the empty piece of weighing paper. Record both masses so you know how much actually got into the flask.

-Add *about* 20ml of water to the flask. Swirl to dissolve some of the KHPh. Be sure to wash down any crystals on the inside, so it becomes part of the solution. It may not dissolve completely but it will continue to dissolve as you titrate. -Add a few drops (2-3) of phenolphthalein to the Erlenmeyer flask containing the KHPh solution.

-Titrate with the sodium hydroxide solution until the first permanent pale pink color is obtained. If you overshoot it, record your data anyway and use it to predict the amount you will need for the next trial more closely. From your data, you should be able to calculate the concentration of the sodium hydroxide.

-Repeat a second trial. Your two trials should be within 1% deviation. If not you must do a third trial. Do not go crazy with trials…once you are sure of what you have, stop!

****You will NOT get any more NaOH solution for next week, once you are out, your lab is over!****

By the end of the double period, you must turn in your data, M calculation, deviation calculation, and final determined M of your base. Be sure to record it for yourself here for the quiz/lab portion next week. (10pts)

Calculated molarity: _____M

Cleaning: All burette rinses are with distilled water

-Use tap water & soap to wash the beakers and flasks
-For the buret, drain any remaining base into the sink and close the stopcock
-Rinse the outside of the tip into the sink using the distilled water bottle
-Fill the burette ~1/3 of the way with distilled water and pour out the top while rotating it
-repeat 2x
-fill it completely and drain the water through the stopcock into the sink or waste beaker
-clamp the buret upside down with the stopcock open
-call me over to check with blue litmus….if it changes color, rinse again

B. Quiz Lab (15pts)

Your grade is based on your performance and calculations:

-Correct answer (within 2% of actual answer=full credit)
-Proper procedure (contamination, obvious procedural errors, improper cleaning afterwards, good scientific technique)
-Calculation work

Using your standardized sodium hydroxide from earlier, you will analyze a particular brand of vinegar. Vinegar is a solution that contains acetic acid and some other material. You may assume that sodium hydroxide reacts with only the acetic acid in you solution. The density of this solution is 1.000g/ml.

Using the burets in the front of the room, place *about* 10.00ml of vinegar into an Erlenmeyer flask; be sure to record the actual amount used for each trial. Add 2-3 drops of phenolphthalein indicator. Wash down the inside of the flask with approximately 20ml of distilled water, and titrate with the standardized sodium hydroxide recording the initial and final buret readings to the nearest .01ml.

You now have enough information to calculate the percentage by mass of acetic acid in this particular brand of vinegar.

You may repeat this analysis as many times as time and your NaOH solution allows. Remember good scientific practices…The calculations leading up to the percentage of acetic acid in vinegar must be clearly shown to receive any credit. Remember sig figs and units.

Titration training videos:

Preparing the buret: https://www.youtube.com/watch?v=MuKh3s73IAM
Titrating: https://www.youtube.com/watch?v=sFpFCPTDv2w
Calculation (you still need to do the % calculation): https://www.youtube.com/watch?v=5-nAF9QadeI