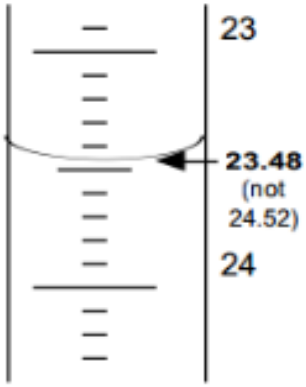
**Acid Base Lab #3 Concentration of Acetic Acid in Commercial Vinegar (Titration); SC7b**

**Introduction:** The neutralization of an acid by a base can be done using titration. In titration, a solution of known acidity, or pH, is added gradually to a basic solution of unknown pH. When the unknown solution is exactly neutralized, as shown by the color of an acid-base indicator or by the reading of a pH meter, it is said that the number of hydronium ions equals the number of hydroxide ions. *moles* $H_3O^+$ = *moles* $OH^-$ In titration, the solutions are dispensed from burettes. The volume used of each solution is calculated by subtracting the volume read before the titration from the volume read after the titration. The volume in a buret can be read accurately to +/- 0.01 mL. Before the titration of the unknown can be done the titrant (solution being used for the titration) must standardized (calculating the accurate concentration). A solution whose concentration is known to a high degree of accuracy is known as a standard solution. The purpose of this lab is to use solid $KHC_8H_4O_4$, potassium hydrogen phthalate (KHP), to prepare a very accurate solution using a titration. KHP is a monoprotic acid. This solution will be used to titrate a solution of sodium hydroxide in order to standardize it. This standardized solution of sodium hydroxide will then be used to titrate vinegar to find the molarity of commercial vinegar.




**Procedure: Part A. Standardization of solution of Sodium Hydroxide**

1. Make 100 mL of a 0.1 M solution of NaOH. You will be provided with a solution of NaOH of known concentration (approximate). Use distilled water, prepare, stopper, and store this in an Erlenmeyer flask.
2. Clean a 50 mL buret thoroughly with distilled water. Mount the buret vertically in a buret clamp attached to a ring stand. Place a white sheet of paper beneath the buret.
3. Rinse the buret with 5 mL of the NaOH solution, 3 times. Let each portion drain out of the buret before the next rinse. Dispose of the waste NaOH. (This step is done so that any water that might be in the buret prior to the experiment will not dilute your NaOH during the titration.) Fill the buret with NaOH.
4. Get approximately 0.5 grams of $KHC_8H_4O_4$ into a ~125 mL erlenmeyer flask. Make sure that you know the exact mass of your solid acid.
5. Dissolve the $KHC_8H_4O_4$ into about 50 mL of water and add 2-3 drops of phenolphthalein. Make sure that it is completely dissolved.
6. Now, slowly titrate the NaOH into the KHP, swirling at all times, until the solution turns the lightest shade of pink possible. The color needs to stay a pale pink for 15-30 seconds. This is the endpoint.
7. Do one "quick & dirty" titration to get an approximate amount.
8. Record all information so that you know exactly how much NaOH was added to the flask.
9. Do at least three trials, with usable data, to insure accurate results. **Rinse out your buret three times with tap water after completion of this experiment and then fill it with water.**
10. Calculate the molarity of the NaOH solution using the mass of the $KHC_8H_4O_4$. Use stoichiometry to do this.

**Part B: Determination of the Molarity of Acetic Acid in Vinegar**

1. Pipette 20 mL of commercial vinegar into a 200 mL volumetric flask (or 25 mL into a 250 mL volumetric) and dilute with distilled water. Transfer this solution to an Erlenmeyer and label it 10% vinegar solution.

2. Pipette 25 mL of the 10% vinegar to a flask. Add 2 drops phenolphthalein indicator. Titrate the vinegar with your standardized NaOH.
3. Do one "quick & dirty" titration to get an approximate amount and then 3 trials. **Rinse out your buret three times with tap water after completion of this Experiment and then fill it with water.**
4. Calculate the molarity of the 10% solution of vinegar.
5. Multiply by 10 to get the concentration of commercial vinegar.

**Acid Base Lab #2 (Formal) Data Sheet; SC7b**

**Data:**
**Part A:** (Numbering corresponds to procedural steps)

1. Calculate **volume** of ___M NaOH needed to make 250ml of 0.1M NaOH. (The molarity will be given to you by your teacher)

   $\mathbf{M_1V_1=M_2V_2}$

   Then dilute to $\mathbf{V_1}$ 250ml in Erlenmeyer flask.

#6 – 9.

| | Trial 1 | Trial 2 | Trial 3 |
|---|---|---|---|
| **Volume NaOH Endpoint (ml)** | | | |
| **Mass $KHC_8H_4O_4$ (g)** | | | |

11. Calculate molarity of NaOH from mass of $KHC_8H_4O_4$. (The equation is given below)

$$NaOH + KHC_8H_4O_4 \rightarrow NaKC_8H_4O_4 + HOH$$

Trial 1 =

Trial 2 =

Trial 3 =

**Average of 3 trials = _____**

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**Questions** You do not have to answer these separately, just be sure to include them in your lab report (rerun).

1. Why did you have to be careful to measure the precise amounts of acids and base used in a titration but you could add as much water as you wanted to the flask while titrating the solution?
2. Discuss at least three sources of error.
3. If a young child drank a large amount of vinegar or other acid, what might be a possible way to help the child?