TITRATION LAB: STANDARDIZING A SODIUM HYDROXIDE SOLUTION

Prelab
Define the terms titration, acid-base indicator, equivalence point, primary standard, and endpoint.

Introduction
It is difficult to make up solutions of sodium hydroxide for which the concentration (in mol dm^{-3}) is known accurately. This is because:

a) Solid sodium hydroxide is **hygroscopic.** This means it soaks up water vapour from the air, which in turn affects its mass.
b) Carbon dioxide in the air and dissolved in the water used to make a NaOH solution will react with the NaOH thereby reducing its concentration.

Purpose
The purpose of the laboratory exercise is to determine accurately the concentration of a solution of sodium hydroxide by titrating an acidic primary standard, potassium hydrogen phthalate ($KHC_8H_4O_4$) , with the sodium hydroxide solution. This process is called **"standardizing the sodium hydroxide solution"**.

Apparatus and Materials

electronic balance
weighing paper
scoopula
solid potassium hydrogen phthalate
Erlenmeyer flask
100 cm^3 beaker
sodium hydroxide solution
wash bottle
buret
buret clamp
retort stand
phenolphthalein solution

Procedure

- Mass between 1.0 g and 1.1 g (to the nearest 0.01 g) of $KHC_8H_4O_4$ on a weighing paper. This will allow the number of moles of acid to be calculated.

- Dissolve the solid acid in approximately 25 cm^3 of water in the Erlenmeyer flask. (The volume of water used is not critical, since you already know the number of moles of acid present in the solid.)

- Add 3 drops of phenolphthalein solution to the Erlenmeyer flask. Be sure you understand the function of the phenolphthalein.

- Use the 100 cm^3 beaker to add NaOH solution to your buret

- Titrate the acidic primary standard in the Erlenmeyer flask with the NaOH solution of unknown concentration in your buret.

- Rinse out the titration flask and repeat the titration until you have <u>at least two</u> titrations that you feel confident were accurately done. Regardless of whether you consider a particular titration "good" or "bad" record ALL data on the data sheet provided.

- For each titration you feel was accurately done, calculate the concentration of the NaOH solution used. If the results do not agree within the limits given by your teacher, repeat the titration
- **Be sure to follow all cleanup procedures at the end of the lab period. Failure to do so will damage the burets.**

Calculations

Once all of the data are collected, the task is to determine the mol dm^{-3} concentration of the NaOH solution used in the titration

- Calculate the number of moles of the known substance. (n = m/M or n = cv)
- Calculate the number of moles of the unknown substance, using the ratio given in the chemical equation.
- Calculate the concentration of the unknown solution. (c = n/V)

TITRATION DATA

l) Show data for all trials, even for those in which you know there was an error. Under "Comments" make a note if you are aware of an error.

m) Put a * beside the trials you decide to use in your calculations. Calculate the concentration of the unkown NaOH solution for at least two trials. Report the average value obtained for the concentration of NaOH

Trial number	Mass of $KHC_8H_4O_4$ used (g, ± 0.01)	Buret Initial reading (cm^3, ± 0.02)	Buret Final reading (cm^3, ± 0.02)	Volume of NaOH used (cm^3, ± 0.02)	Comments

Conclusion and Data Evaluation