LABORATORY EXPERIMENT 3

Alkalimetric Titration of an Acid

A carbonate-free sodium hydroxide solution is prepared and standardized.

Preparation and standardization of sodium hydroxide solution.

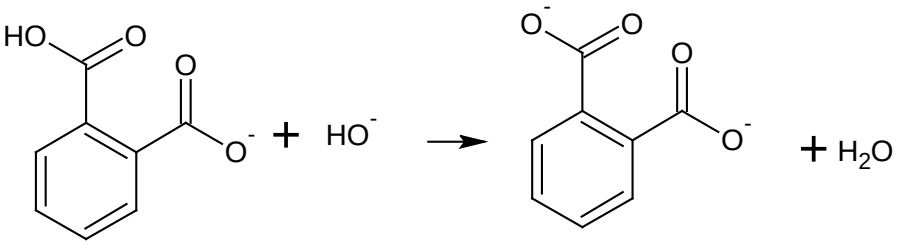
Our goal is to prepare a carbonate-free sodium hydroxide solution and standardize it. Sodium hydroxide is the most common reagent for alkalimetric titration (KOH and $Ba(OH)_2$ are also employed). None of these reagents is obtainable as a primary standard: standardization of solutions is always necessary.

Preparation of carbonate- free 0.1 M NaOH. Boil approximately 1 L of deionized water and cool it to room temperature. Add around 8-9 g of 50% NaOH solution and mix well. Immediately transfer the solution to the storage bottle.

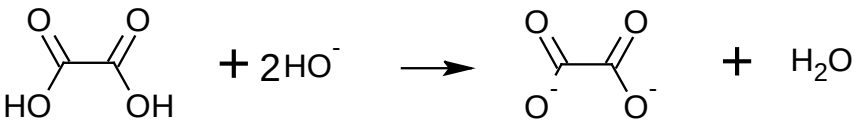
Standardization of 0.1 M NaOH. Several primary standards are available for alkali solutions.

All of them are weak organic acids that require the use of indicator with a basic transition range.

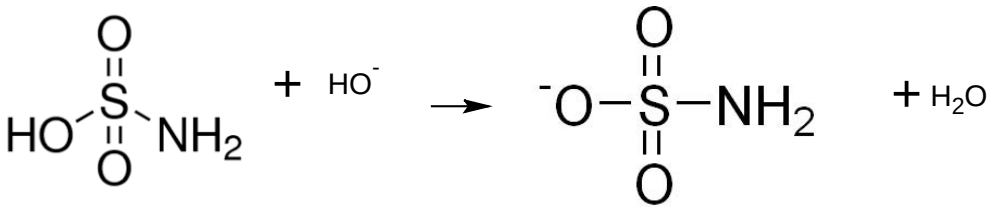
***Potassium hydrogen phosphate, KHP (FW 204.233*).** The pure solid is dried at 105 °C before use. Weigh individual 0.5-0.8 g samples (to the nearest 0.0001 g) and dissolve in around 50 mL of water. Add 2-3 drops of phenolphthalein and titrate until stable pink color.



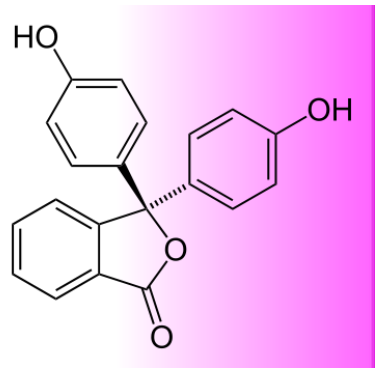
Oxalic acid dihydrate (FW 126.07). Weigh individual 0.2 g samples (to the nearest 0.0001 g) and dissolve in around 50 mL of water. Add 2-3 drops of phenolphthalein and titrate until stable pink color.



Sulfamic Acid (FW 97.10). Weigh individual 0.3 g samples (to the nearest 0.0001 g) and dissolve in around 20-30 mL of **water**. Add 2-3 drops of phenolphthalein and titrate until visible pink color.



Thymol blue can be used instead of **phenolphthalein** in all these titrations: repeat titrations using thymol blue.



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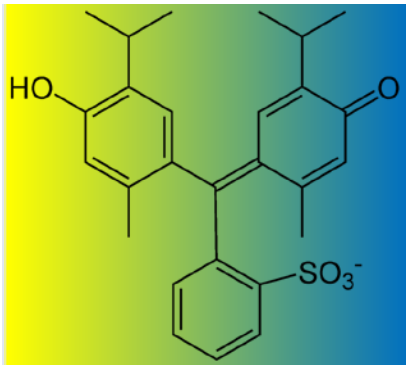

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Calculate the molarity of sodium hydroxide solution using the equation:

$$\boldsymbol{Molarity_{NaOH} = \frac{m(g) \times a \times 1000}{FW \times V(mL)}}$$

where ***a*** is a number of protons titrated (**1** in case of KHP and benzoic acid, **2** in case of oxalic acid). Use the provided template Excel file to facilitate your calculations.

As usual, estimate the uncertainty of your results.

Obviously, the results from all titrations should be consistent.

Use this number for future titrations with NaOH.