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AP LAB 04EF: Acid versus hydrogen carbonate titration

Aim To standardize (find the molarity) of a solution of HCl with a standard $NaHCO_3$ solution

Apparatus Buret, pipet, pipet filler, Erlenmeyer flask, funnel, stand

Chemicals A standard $NaHCO_3$ solution (AP LAB 04E), HCl, methyl orange indicator

Method

1. Pipet exactly 10.00 mL of the $NaHCO_3$ solution into an Erlenmeyer flask and add two drops of indicator.

2. With the aid of a funnel, carefully fill the buret with HCl, noting the initial reading. The buret need not be filled exactly to the 00.00 mL mark but should be close to it. Record the reading to two decimal places making the final decimal place either a 0 or a 5 (depending on whether the meniscus is ON a graduation mark, or BETWEEN a graduation mark).

3. Carefully add HCl from the buret to the $NaHCO_3$ solution with gentle swirling.

4. Initially the acid can be added quickly, but nearer the endpoint the acid must be added more carefully and ultimately drop wise. (The first titration is usually a rough one since the endpoint is not known, and it is easy to miss the sharp endpoint). Use the white base of the stand to help observe the sharp color change and then record the final buret reading.

5. Repeat as necessary until three consistent titres have been recorded.

Titration Procedure

Preparation of the primary standard: (AP LAB 04E). The primary standard is the solution whose concentration is known. A mass of a solid (the solute) is accurately weighed and transferred carefully to a volumetric flask. The solid is then dissolved in a small amount of water (the solvent) and the solution made up to the graduation mark. To ensure accuracy great care must be taken at all stages, with careful, accurate weighing, careful transfer of solid and clean glassware. Solids that are to be used as standards must be pure, dissolve in water easily, should not decompose and should have a relatively high molar mass.

Filling the buret: The solution that is to be standardized is placed in the buret. The buret should be washed through with some of the solution first and then carefully filled to a point near the top using a funnel. Record the starting reading.

Using the pipet: A small amount of the standard solution can be drawn into the pipet with a safety filler and then discarded in order to wash it out. The pipet can then be filled above the graduation mark. Then carefully allow the solution out of the pipet until the bottom of the meniscus touches the graduation mark. This is a tricky procedure but with practice becomes easier. The solution can then be transferred to clean Erlenmeyer flask ready for titration.

Performing the titration: A few drops of indicator can be added to the Erlenmeyer flask, and the flask placed underneath the buret. A white background is useful to aid the observation of the color change. Having noted the starting reading the solution in the buret can be run into the flask a few mL at a time, each time swirling the flask gently. As the end point is neared the buret solution should be added drop wise. Note the final reading. The buret should be read to 0.05 mL and a number of titrations should be performed until two or three consecutive titres within 0.05 mL are recorded. An average value can be calculated.

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Results

	Titration					
	Rough	1	2	3	4	5
Final buret reading in mL						
Initial buret reading in mL						
Titre in mL						

Average titre =_____ mL

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Conclusion/Calculation

Use your data (including that from AP LAB 04E) to calculate an accurate concentration (molarity) for the hydrochloric acid.

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