Experiment # 7  Analysis of commercial Antacid

I. PURPOSE OF THE EXPERIMENT
In this experiment, neutralizing power of Sodium bicarbonate and Milk of magnesia (Antacid) will be compared by titrating with approximately 0.25M HCl (Hydrochloric acid).
(A) It will initiate with finding the effectiveness of sodium bicarbonate in neutralizing a portion of the Standard HCl……M solution using Phenolphthalein as an indicator.
(B) After that study one brand of commercial antacid (Milk of Magnesia) in a similar fashion.

II. INTRODUCTION
To neutralize acid indigestion (Gastric Hyperacidity) drink a glass of water containing one half-teaspoon of baking soda (sodium bicarbonate, also called sodium hydrogen carbonate) or other drugstore remedies available.

The antacid tablets used in this experiment contain, Mg(OH)₂ (Milk of Magnesia) as active ingredient. Milk of Magnesia or Magnesium Hydroxide, Mg(OH)₂ is a saline osmotic (hydrating) laxative. The name derives from the suspension's milky white appearance and the magnesium in its composition.

These have the advantage over NaHCO₃ of introducing no Na⁺ ions, which make rise in high blood pressure and other side effects. Mg²⁺ ion, however, has mild laxative properties. Experimental results will be used to make a “per gram” comparison of the antacid effectiveness between sodium bicarbonate and the milk of magnesia (commercial antacid).

Sodium bicarbonate or antacid is dissolved in a measured volume of HCl of known molarity.

\[
\text{NaHCO}_3 (aq) + \text{HCl (aq)} \rightarrow \text{NaCl (aq)} + \text{H}_2\text{O(l)} + \text{CO}_2(g)
\]

sodium + hydrochloric acid → sodium chloride + water + carbon dioxide

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Mg(OH)₂ (aq) + 2HCl(aq) → MgCl₂(aq) + 2H₂O(l)
Magnesium hydroxide + Hydrochloric acid → Magnesium chloride + water

The amount of HCl remaining in the solution is then determined by titrating the HCl with sodium hydroxide titrant of known molarity.

The difference between the initial number of moles of HCl and the number of moles of “unreacted” HCl titrated gives the number of moles of HCl neutralized by the sodium bicarbonate or antacid. That value is the measure of the number of equivalents of sodium bicarbonate or antacid present to neutralize the acid.

**Note 1:** Vigorous boiling of the solution drives off any CO₂ formed in the neutralization reaction. The end point is then sharper and more easily identified in the titration.

**Note 2:** If the phenolphthalein indicator turns pink before any NaOH titrant is added enough standardized HCl should be added to convert the indicator to its colorless form. This additional volume must be included in the total volume of HCl for the calculations.

### III. EXPERIMENTAL

3.1 Chemicals: Standard HCl solution……M, Standard NaOH solution….M,
NaHCO₃ sodium bicarbonate,
commercial antacid (milk of magnesia),
Phenolphthalein indicator

3.2 Equipment: Titration set

3.3 Procedure

3.3.1 Sodium bicarbonate analysis

Place standard HCl………M in the burette and transfer 25 mL of this standardized HCl solution into the conical flask. Weigh 0.3 – 0.4 grams of sodium bicarbonate on the watch glass and carefully empty this into the conical flask containing a measured volume of HCl. Use 40 mL distilled water to wash down the inner walls of the flask and swirl it properly to dissolve the sodium bicarbonate. Boil the solution for at least 3-5 minutes (see Note 1).

**CAUTION:** Avoid loss of sample by splattering; if most of the water boils away you will get poor results.
Run tap water over the hot conical flask to cool the contents and titrate the solution with Standard NaOH solution \( \ldots \) M, using phenolphthalein indicator. Repeat this procedure with additional NaHCO₃ samples, until the ratio of for at least two samples differ by no more than 2%.

### 3.3.2 Analysis of commercial antacid (milk of magnesia)

Place standard HCl \( \ldots \) M in the burette and transfer 25 mL of this standardized HCl solution into the conical flask. Weigh \( \ldots \) mL of antacid in the weighted beaker and carefully empty this into the conical flask containing a measured volume of HCl. Use 40 mL distilled water to wash down the inner walls of the flask and swirl it properly to dissolve the antacid. Boil the solution for at least 3-5 minutes (see Note 1).

**CAUTION**: Avoid loss of sample by splattering; if most of the water boils away you will get poor results.

Run tap water over the hot conical flask to cool the contents and titrate the solution with Standard NaOH solution \( \ldots \) M, using phenolphthalein indicator. Repeat this procedure with additional antacid samples, until the ratio of for at least two samples differ by no more than 2%.

### IV. RESULTS and DISCUSSION

(i) Moles of HCl neutralized per gram NaHCO₃

(ii) Moles of HCl neutralized per gram Antacid

**Discuss**: how this analysis can be useful in taking sodium bicarbonate or antacid while suffering indigestion.

### V. CONCLUSION

On a per-gram basis, \( \ldots \) has the greater neutralizing power.
Calculation

1st Titration.
10 mL of Std. NaOH solution \( \equiv M \) \( \equiv A \) mL of sodium bicarbonate sample

Indicator: Phenolphthalein

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<thead>
<tr>
<th>Sample No.</th>
<th>Initial volume / mL</th>
<th>Final volume / mL</th>
<th>Difference / mL</th>
<th>mass of NaHCO(_3) / g</th>
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Calculation

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<th>Volume of HCl / mL</th>
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<th>Moles HCl neutralized / mol</th>
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2nd. Titration.

10 mL of Std. NaOH solution \( \equiv M \) A mL of antacid sample

**Indicator: Phenolphthalein**

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