**Titration Antacids Lab**

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**Introduction**

Antacid tablets are used to counteract excess stomach acid. This counteraction is a process known as neutralization. The acid in the stomach reacts with the base chemical in the antacid, in this case CaCO3, to produce water and a salt.

Neutralization is the process of an acid combining with a base to form water, a neutral substance. Neutralization is one of many types of chemical reactions, because it combines chemicals to form two new substances, water and a salt. To determine the amount of either an acid or base one has, a method called titration can be used. Titration is the process of combining an acidic chemical and a basic chemical in a controlled, measured amount generally using a tool called a buret. The buret will allow the user to accurately measure the amount of chemical that is being combined. When the appropriate ratio of moles of the base has combined with the number of moles of the acid, the substance will become neutral. From the reactions chemical equation one can determine the ratio of the amount of moles necessary for the combination to neutralize. In this method, a pH indicator must be used to present when the combination has become neutral. The specific indication will appear as different colors when it is contained inside an acidic, basic, and neutral substance. When combining the acid and base, it is important that the user only combine enough so that indicator remains in its "neutral color".

Titration is performed in an important process called standardization. Standardization is used to determine the concentration of a certain chemical when dissolved in water. Some chemicals have the property of absorbing water when exposed to the air. This property makes it extremely difficult to maintain an accurate measurement of its concentration. By standardizing the chemical, one can correctly determine the number of moles of chemical that is dissolved in the water. This process involves titrating the unknown aqueous chemical with a chemical in which the molarity is known. Molarity is known as the number of moles of chemical per liter of solution. So after titration and neutralization has occurred, the number of moles of the unknown can be calculated.

In this lab the method of standardization is used to find the molarity of both the NaOH and HCl. This is accomplished by using a known amount of KHP to standardize the NaOH, then subsequently using the NaOH to standardize the HCL. After the chemicals are standardized, the number of moles of CaCO3 in each antacid tablet can be determined by using what is known as back titration. The antacid tablet is dissolved and reacted in a controlled amount of HCl solution, in this case 50.0mL, to partially neutralize the HCl. The remaining HCl can then be neutralized by titrating it with the NaOH. After measuring the amount of NaOH used, the number of moles of CaCO3+ in the antacid tablet can be calculated by simple subtraction. The mass of the CaCO3 is then determined by using the molar mass, in this case 100.09g per mole.

**Data**

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| --- | --- |
| Amount of KHP | Amount of NaOH required to neutralize chemical |
| 1.10 g | 27.2 mL |
| 1.12 g | 27.4 mL |

|  |  |
| --- | --- |
| Amount of HCl | Amount of NaOH required to neutralize chemical |
| 10.0 | 17.1 mL |
| 10.0 | 17.6 mL |

|  |  |
| --- | --- |
| Brand of Antacid | Amount of NaOH required to neutralize antacid & HCl combination |
| Meijer | 33.2 mL |
| Tums | 34.6 mL |

**Calculations**

Standardizing the NaOH:

1.12g KHP ( 1molKHP/204.42g KHP) = .00549m KHP

.00549mKHP ( 1m NaOH/ 1m KHP) (1/ 27.4mL NaOH) ( 1000mL/ 1L) = .200 M NaOH

Standardizing the HCL:

17.1 mL NaOH ( 0.198m NaOH/ 1000mL NaOH) (1 m HCl / 1 m NaOH) ( 1 / 1.00 x 10-3 L HCl ) = .339 M HCl

Determining the CaCO3 in Meijer Antacid

(.339m HCl/ 1 L HCl) ( 1 L HCl / 1000mL HCl ) (50.0 mL Hcl) - ( 0.200 m NaOH / 1 L NaOH ) ( 1 L / 1000mL ( 33.2mL NaOH) = 1.03 x 10-2­m

1.03 x 10-2­­m HCl ( 1m CaCO3 / 2 m HCl) (100080mg CaCO3 / 1 m CaCO3) = 516 mg CaCO3

Determining the CaCO3 in Tums Antacid

(.339m HCl/ 1 L HCl) ( 1 L HCl / 1000mL HCl ) (50.0 mL Hcl) - ( 0.200 m NaOH / 1 L NaOH ) ( 1 L / 1000mL ( 34.6mL NaOH) = 1.00 x 10-2­m

1.00 x 10-2­­m HCl ( 1m CaCO3 / 2 m HCl) (100080mg CaCO3 / 1 m CaCO3) = 500 mg CaCO3

**Conclusion**

The mass of the active ingredient in an antacid tablet, CaCO3 is calculated to be:

Meijer Brand: 516 mg CaCO3

TUMS Brand: 500 mg CaCO3