**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ How much calcium carbonate is in that antacid tablet?**

# Introduction: One of the main ingredients in antacid tablets (such as Rolaids, Tums etc.) is calcium carbonate, which helps to neutralize stomach acid in the following general reaction;

**Acid + Carbonate 🡪Salt + Water + Carbon Dioxide**

There are also a number of other ingredients in these tablets such as binders, which hold the tablet together, but that you can assume contain no calcium or carbonate ions. In the lab, we can mimic the action of antacids in the stomach by reacting the calcium carbonate with hydrochloric acid (often helped by the addition of a few mL of distilled water and some very gentle heating). The binding materials will not dissolve (they are insoluble in acid). Aqueous calcium ions can be precipitated by the use of a solution of carbonate ions.

# Materials: Filter papers and funnels, various pieces of normal laboratory glassware (beakers etc.), stirring rods, mortar and pestle, drying oven, hot plate, Antacid tablets, 3 M HCl, distilled water, 1 M Na2CO3.

# Pre-Lab Questions:

1. Write the chemical equation for the reaction between solid calcium carbonate and aqueous hydrochloric acid.
2. Write the chemical equation for the reaction between aqueous calcium chloride and aqueous sodium carbonate.
3. Each box below corresponds to a specific section of the procedure. Draw a model that represents where the calcium is at each step of the procedure and in what form (Ca(s), Ca+2(aq) CaCO3(s), etc). Also include where other substances are when appropriate (HCl, CO3-2, binders, fillers, dyes, Na+, Na2CO3, etc)





1. Explain why the hydrochloric acid should be the excess reactant in the first reaction.
2. What test could be done to ensure that all of the basic CaCO3 has been dissolved in Hydrochloric acid, so the acid is the excess reactant?
3. The label claims there is 750mg of CaCO3 inside each tablet as the “active ingredient.”
4. How many milliliters of 1M Na2CO3 are needed to react with the calcium ions?
5. What is the theoretical mass of calcium ions in the tablet?
6. In experiments where precipitates are formed and collected via filtration from aqueous solutions, the failure to completely dry the precipitate always has the same consequence. What is that consequence?
7. Explain why the filter paper should be weighed during the experiment.
8. Explain why glassware should be cleaned before the experiment.

Plan your procedure:

Data:

# Post Lab Questions:

1. Calculate the mass of Ca+2 ions in your tablet.
2. Calculate the percent yield.
3. Calculate the percent of CaCO3 in your tablet.
4. Discuss the possible sources of error in your experiment. BE SPECIFIC.
5. The concentration of barium ions in any solution can also be determined via gravimetric analysis. An impure sample of barium nitrate with a mass of 1.234 g, is completely dissolved in water and the resulting solution is reacted with an excess of aqueous sodium sulfate. A precipitate forms, and after filtering and drying, it was found to have a mass of 0.848 g.
6. Write the chemical equation for the reaction of aqueous sulfate ions and aqueous barium ions.
7. Why would you add excess sodium sulfate?
8. Calculate the percent of barium in the original 1.234g sample.



Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ **Calcium Ion Post Lab Questions**

Another class of students used a different antacid than you. For each experiment, fill in the data that matches the errors made below. Then, using that data, calculate the percent of Calcium in the tablet. **Show your work.**

|  | **Good results** | **Error Team 1** | **Error Team 2** |
| --- | --- | --- | --- |
| **Tablet Mass** | 2.00g | 2.00g | 2.00g |
| **Filter paper mass** | 1.002g |  |  |
| **Filter paper + CaCO3 mass** | 1.030g |  |  |
| **Mass of CaCO3** |  |  |  |

* Good results:
* Error Team 1: A student in team 1 added hydrochloric acid too quickly and the solution spilled over. The spilled part was not recovered, but some solution remained in the reaction beaker. The team continued the lab with the remaining solution.
* Error Team 2: A student in team 3 massed the final filter paper while it was wet, and then proceeded to filter and dry the final product.

For each experiment, explain how the errors affected the percent of Calcium in the tablet.

Error 1:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Error 2:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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A student wants to determine if using NaNO3 (instead of Na2CO3) as the second solution would affect the calculated mass of calcium in the tablet. Explain below how the student can set up the investigations. Include variables, controls, and a brief description of the procedure. Predict if the student would obtain similar results. Explain your answer.

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