Plop, plop….Fizz, fizz  Ahhhh, What a relief!!

Introduction:
Various antacids claim to give the “best relief” for acid indigestion, but how do you really know which antacid is the best buy for your money? Never fear!! Your knowledge of chemistry will come in handy as you find the neutralizing power of three brands of antacid.

This experiment determines the effectiveness of several antacids by using a procedure known as an acid-base titration. You will simulate your stomach by adding 25.0 mL of 0.1 M HCl into a flask You will then add part of a crushed antacid tablet to the flask to neutralize as much acid as possible. By performing a simple titration, you will determine the amount of acid not neutralized by the antacid tablet.

In order to determine when all the acid has been neutralized an acid – base indicator will be used. This indicator will change color depending on whether the solution is acidic or basic. The point at which the indicator turns from one color to the next is called its end point. This signals that your titration is complete.

Objectives:
- Perform an acid base titration to determine the amount of acid neutralized by each antacid tablet
- Determine the best antacid for your money based on your experimental results.

Materials:
- Biuret
- 0.1M HCl
- 0.1M NaOH
- 3 brands of antacid tablets
- Distilled water
- Mortar and pestle
- Phenolphthalein indicator
- Triple beam balance
- Scoopula
- 3-250 mL beakers
- Funnel
- Paper
- Glass stirring rod
- pH probe
- 100 mL graduated cylinder

Procedure:
Neutralizing Acid with antacids: (stomach simulation)
1. Select three types of antacid tablets. Record the total price of the bottle and # of tablets per bottle.
2. Label three 250 mL beakers with the brand of each antacid tablet you selected.
3. Put 25.0 mL of 0.1M HCl in each of the three beakers.
4. Using a mortar and pestle, pulverize each antacid tablet. Empty the contents onto a clean, labeled piece of paper.
5. Weigh out 0.40 grams of each type and add this to the respective labeled beaker containing 25.0 mL of 0.1 M HCl.
6. Stir each beaker in order to dissolve the tablet. Some of the “fillers” used to make the tablet might remain undissolved.
7. Add 5 drops of phenolphthalein indicator to each of the three beakers. Phenolphthalein is clear/cloudy in acidic solutions and pink in basic solutions. Each of the flasks should be colorless. If any of them are pink inform your instructor.
8. Set up your pH probe. Record the pH of the original “stomach acid” solution.

Titrating the remaining acid: (determining how much acid is left after taking an antacid)
1. Clean a buiret and rinse it thoroughly with distilled water.
2. Fill the buiret with the 0.1M NaOH. Release some of the NaOH from the tip to ensure there are no air bubbles or excess water in the tip.
3. Record the initial volume of NaOH in the buiret.
4. Titrate each of the beakers with the acid and antacid in them until you reach a light pink equivalence point. Do this very slowly. It is VERY easy to overshoot your end point. Sometimes only a drop is needed. Keep each flask for reference to compare your other end points to. The colors should match up fairly closely. Record the final volume of NaOH in the buiret once the equivalence point is reached.
5. Record the pH of the “neutralized stomach acid” solution.
6. Refill the buiret and repeat with each of the other two beakers.
Data: In addition to filling out the chart, included general qualitative observations as you perform the experiment.

<table>
<thead>
<tr>
<th>Antacid Brand</th>
<th>Price per bottle</th>
<th># of tablets/bottle</th>
<th>Cost per tablet (Total Cost/# of tablets)</th>
<th>Initial buret reading (mL)</th>
<th>Final buret reading (mL)</th>
<th>Amount of acid neutralized (mL) (Final – Initial)</th>
<th>Amount of acid neutralized (25.0 mL – mL acid NOT neutralized)</th>
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pH of original “stomach”: (before titrating) Beaker #1: _______ Beaker #2: _______ Beaker #3: _______
pH of stomach at the end of titration: Beaker #1: _______ Beaker #2: _______ Beaker #3: _______

Analysis: Show all calculations!
1. Calculate the cost/tablet for each antacid brand.
2. Write the name and formula of the active ingredient(s) in each of the antacid tablets. Is the active ingredient acting as an acid or a base? Explain your reasoning.
3. Calculate the [H+] and [OH−] in beaker before you began your titration AND after you stopped the titration.
4. Explain why the phenolphthalein changed from cloudy or clear to pink during your titration.
5. Look up other acid-base indicators in your textbook or online. Write down the names of three of them. Include the pH range that they turn color in. For each one state if it would work well for this experiment or not. Give a reason for your answer.
6. Write a balanced equation for the neutralization reaction you performed when titrating the left over hydrochloric acid, HCl, in the flask with sodium hydroxide, NaOH. Include the correct states of matter for each substance.
7. The acid in your beaker was meant to simulate your stomach acid. Discuss at least two variables that could be different in relation to your stomach acid vs. the acid we used that could potentially affect the results of this experiment.
8. Marketing companies must appeal to consumers in an effort to get them to purchase their product. Describe three other characteristics of an antacid that advertisers might highlight in order to get you to buy their product?

Error Analysis:
Discuss two sources of error in this lab.

Conclusion:
Follow rubric guidelines. For the results section answer the following questions. Which of the antacids worked the best? The worst? Explain your reason citing data to back up your claim.