

Chemistry – Antacids and Neutralization of Acids

The stomach lining is covered by gastric pits that extend into the deeper tissue layer. Parietal cells which produce gastric acid (hydrochloric acid) line these pits. The acid they produce is essential for the digestion of food and the destruction of most bacteria and some viruses that can be found in food. However, at times the stomach produces too much acid which can lead to indigestion and heartburn.

Antacids are over the counter-the-counter (OTC) medications that neutralize stomach acid. The composition of antacids varies according to the manufacturer's recipe. Common ingredients include aluminum hydroxide, magnesium carbonate, magnesium hydroxide, magnesium trisilicate, sodium bicarbonate, and calcium carbonate. Additionally, some antacids include anti-gas or anti-foam ingredients and flavorings.

In this activity you will examine various commercially available antacids and identify which antacids are the most effective at neutralizing acid.

Materials

Rolaids* ¹	Water
Rolaids Extra Strength* ¹	500 mL beaker – 1
Tums* ¹	Pipette
Tums Extra Strength* ¹	Marker
Maalox* ¹	Ruler
Maalox Strength* ¹	Hydrochloric acid
Alka-Seltzer* ¹	Weigh boat
Alka-Seltzer Extra Strength* ¹	Scoopula
Generic or store-brand antacid* ¹	Balance
Test tubes – 10	Mortar and pestle
Test tube rack	Universal indicator, bromothymol blue or pH paper
Rubber stoppers – 10	

*Choose white antacids. Coloring agents added to antacids can interfere with the pH indicators.

¹Antacids must be crushed to a powder. This may be done before the lab. If not, students should use the mortar and pestle to crush tablets. Crushed antacids can be poured into small labeled beakers or extra test tubes. Make sure to clean the mortar and pestle between samples. If the antacids are crushed before lab, then sample tablets need to be provided so that students can measure the weight of tablets. The weight of individual tablets should be measured. The effective dose as recommended by the manufacturer should be noted in the table below.

1. Retrieve 10 test tubes, 10 rubber stoppers and a test tube rack. Label one test tube water and then label the other 9 test tubes with the antacids name's.
2. Use the ruler to mark each tube 5 cm from the bottom of the tube.
3. Turn on the balance. Place the weigh boat on the balance and push the 'tare' button. This action will zero the balance.
4. Use the scoopula to add .2 gms of crushed Rolaids to the weigh boat. Pour the Rolaids into the test tube labeled Rolaids. Wipe out the weigh boat with a dry paper towel.

5. Repeat step 4 with the other 8 antacids.
6. Fill all the test tubes (including the test tube marked water) to the 5 cm mark with distilled water.
7. Insert a rubber stopper into each test tube. Invert each test tube several times until the antacids dissolve. Be careful with the Alka-Seltzer, carbon dioxide is released in the reaction and will pop the stopper out of the tube.
8. Add 3 drops of the universal indicator to each tube.
9. Insert the rubber stoppers into each test tube and invert to mix the contents.
10. Record the pH of each solution in the table below.

Write a hypothesis for this activity. Which antacid do you think will be most effective?

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Universal indicator	Red	Orange	Yellow	Green	Blue	Purple	Pink	Light Blue	Light Green	Light Yellow	Light Orange	Light Red	Light Purple	Light Pink	Light Blue
Bromothymol blue	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow

11. Pour 200 mL of hydrochloric acid into the 500 mL beaker.
12. Use the pipette to add 3 drops of HCl to each test tube.
13. Re-stopper all of the test tubes and invert to mix. Determine the pH of each solution.
14. Repeat steps 12 and 13 until the pH of a solution has changed 1 pH unit. Record the number of drops needed to change the pH of the solution in the chart below.
15. Repeat steps 12 and 13 until each solution has dropped another pH unit (a total change of 2 pH units).
16. Record the number of drops needed to change the pH 2 units in the table below.

Sample	Composition of Tablet	Tablet Mass (gms)	Recommended Dosage (number of Tablets)	pH of Initial Suspension	Number of Drops Needed to Decrease pH 1 Unit	Number of Drops Needed to Decrease pH 2 Units
Water						
Rolaids						
Rolaids ES						
Tums						
Tums ES						
Maalox						
Maalox ES						
Alka-Seltzer						
Alka-Seltzer ES						
Generic						

This experiment used 2 grams of material. Complete the following table to determine the neutralization ability of the antacids based on the manufacturer recommended dosage.

		A	B	C	D	E	
Sample	Composition of Tablet	Tablet Mass (gms)	Recommended Dosage (number of Tablets)	Mass of Single Dose in Grams (= A x B)	Number of Drops Needed to Decrease pH 1 Unit	Number of Drops Needed to Decrease pH 1 Unit for Dose = (C/2 gms) * D	Rank of Antacid (1- most drops, 9 – fewest drops)
Roloids							
Roloids ES							
Tums							
Tums ES							
Maalox							
Maalox ES							
Alka-Seltzer							
Alka-Seltzer ES							
Generic							

Graph your results below.

Was your hypothesis supported?

Which antacid was the most effective? _____ How are you defining effective?

Was there a difference in the number of drops required to decrease the pH 1 unit and the number of drops needed to decrease the pH from 1 to 2 units? How do you explain that difference?