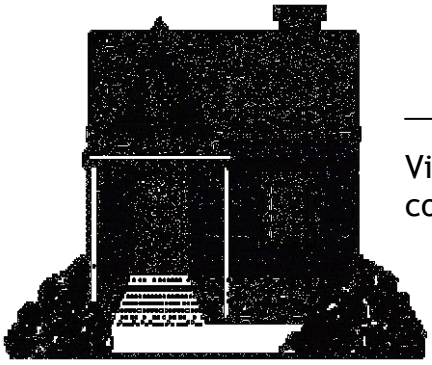


As The Stomach Churns

Visitors compare how an antacid compound and an antacid/anti-gas compound react with artificial stomach fluid.

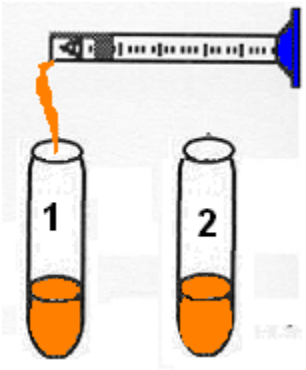
OBJECTIVES: Visitors learn how some common over-the-counter medications work.

SCIENCE TOPICS	PROCESS SKILLS	VOCABULARY
pH	Observing	Molecule
Chemical Reactions	Measuring	Acid
	Controlling Variables	Indicator
	Comparing	

The Stomach Churns

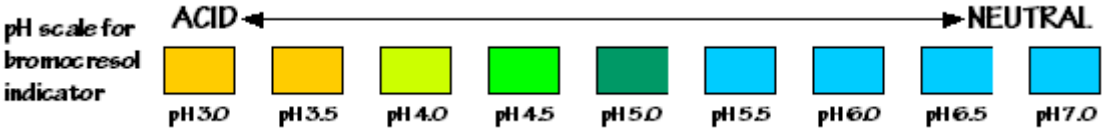
Procedure

1. Always wear safety goggles.
2. Rinse the graduated cylinder and the two test tubes in the sink.
3. Use the graduated cylinder to measure 15 ml of artificial stomach fluid. Pour this into test tube

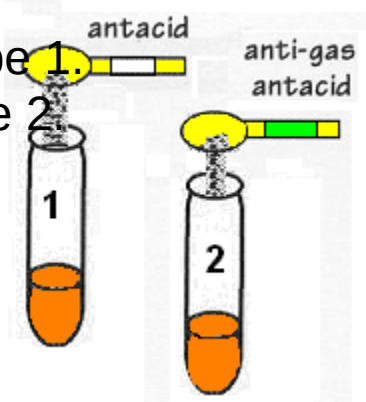


4. Repeat measuring and adding stomach fluid to test tube 2.
5. Screw the caps on tightly and shake each test tube well

How much foam is in each bottle?
What color is the fluid? Is it an acid or neutral?



6. Add one scoop of antacid powder to test tube 1. Add one scoop of anti-gas powder to test tube 2.



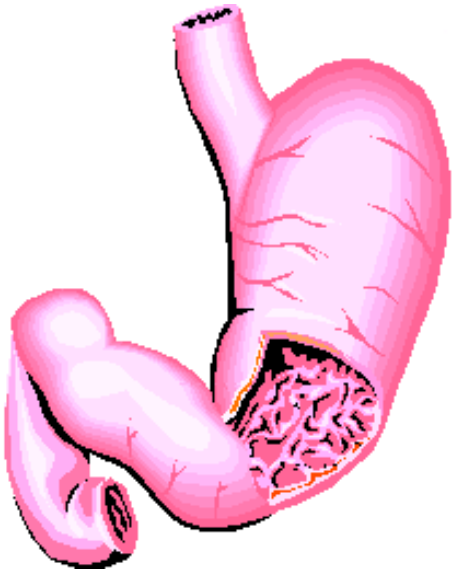
7. Recap the tubes and shake them well.

How much foam is in each bottle now?
What color is the fluid? Is it still acid?

8. Empty and rinse the test tubes and graduated cylinder in the sink.

What is antacid used for?

How does it work?



Closer Look:

Your stomach makes hydrochloric acid (HCl) to help digest food. If your stomach makes too much acid, the acid can begin to eat away your stomach, causing indigestion or heartburn. Stomach muscles churn the acid, food, and fluids, creating gas bubbles, which add to heartburn. In this experiment, your stomach fluid is represented by a solution of hydrochloric acid (stomach acid) and soap (to create the "gas bubbles").

People use antacids to neutralize the extra acid in their stomachs. Many antacids contain calcium carbonate ($CaCO_3$), which reacts with the strong hydrochloric acid in stomach fluid. This produces neutral calcium chloride ($CaCl_2$) and weak carbonic acid (H_2CO_3). In this experiment, a color change shows that the antacid is working. The color change comes from an indicator that is yellow in strong acids and blue in weak acids or bases.

Anti-gas medicines usually contain simethicone, a large silicon-containing molecule that interferes with the stomach's ability to form the bubbles that add to heartburn.

MATERIALS

- (with amounts to have on hand)
- One 25-ml graduated cylinder
- Two plastic test tubes (about 100-ml) with screw caps
- Two small (about 4-oz) jars or containers with lids
- Two 1-ml or ¼-tsp measuring spoons
- One 250-ml squeeze bottle
- $CaCO_3$ (calcium carbonate powder) (keep 500 g on hand)
- 1M HCl (hydrochloric acid) (keep 1 L on hand)
  — OR — concentrated (12M) HCl (keep 200 ml on hand)
- Dish-washing soap (keep 8 oz on hand)
- Bromocresol green solution (keep 50 ml on hand)
  — OR — bromphenol blue sodium salt (keep 10 g on hand)
- One 1000-ml glass bottle
- One large jar (500-ml) with lid
- One medium to large jar (250-ml or larger) with a lid
- One 50-ml bottle
- 30% simethicone emulsion (Dow-Corning® 7-9245, also known as polydimethylsiloxane) (keep 4 oz on hand)

  OR

  "SafeStep$_{TM}$" de-icer (contains mostly KCl)

Setup/Takedown Procedures

ORIGINAL SETUP

- Color code and label the two plastic test tubes "1" and "2." Color code and label the lids to match the labels on the bottles.
- Color code and label the two small jars "1 Antacid" and "2 Anti-Gas." (The color of the labels should match those of the bottles above.)

- Color code and label the two measuring spoons “1” and “2” to match the labels on the bottles and jars.
- Label the 250-ml squeeze bottle “Artificial Stomach Fluid.”
- Color code and label the large jar “Calcium Carbonate ($CaCO_3$) for Antacids (1)” to match bottle 1 and jar 1.
- Color code and label the medium jar “SafeStep (KCl) -- Anti-Gas (2)” to match the labels of bottle 2 and jar 2.
- Label the 1000-ml glass bottle “Artificial Stomach Juice.”

WEEKLY SETUP

- Make up new solutions as necessary

DAILY SETUP

- Set out the visitor instructions in a Plexiglas holder.
- Fill the “Artificial Stomach Fluid” squeeze bottle, small “1 Antacid” jar, and small “2 Anti-Gas” jar.
- Remove the lids from the jars and insert the appropriate measuring spoon.
- On a tray lined with a white mat, set out the following:
  - Two color-coded, labeled test tubes with matching labeled lids
  - Two small, color-coded, labeled measuring spoons
  - Small, color-coded, labeled jar marked “1 Antacid”
  - Small, color-coded, labeled jar marked “2 Anti-Gas”
  - One 25-ml graduated cylinder
  - One 250-ml squeeze bottle labeled “Artificial Stomach Fluid”

DAILY TAKEDOWN

- ❑ Thoroughly clean the test tubes, lids, and graduated cylinder.
- ❑ Recap the jars.
- ❑ Return all materials to the experiment tub.

- Return any fluid in the "Artificial Stomach Fluid" bottle to the stock bottle.
- Clean the squeeze bottle.
- Relabel and clean the materials as needed.
- Return the tray and mat to general lab storage.

RUNNING SUGGESTIONS

- Check and replenish the supply of "Artificial Stomach Fluid" frequently.
- Check "1 Antacid" and "2 Anti-Gas" jars periodically for signs of moisture. If the powders become hard and caked, clean the jars and refill them with fresh powder.

EXTENSIONS

Try this experiment with commercial medications and compare the results.

Safety & Disposal

Na_2SO_3 (sodium sulfite), HCl (hydrochloric acid), and NaOH (sodium hydroxide) are hazardous substances; follow the handling and disposal instructions.

"Artificial Stomach Fluid" contains 1% v/v (0.2M) HCl (hydrochloric acid). Wash your hands after using it.

Consult the Material Safety Data Sheets (MSDS) for additional information.

MATERIALS PREP

To prepare artificial stomach fluid:

- ❑ Add 800 ml water to a one liter beaker
- ❑ Add 200 ml 1 M HCl

- ❑ Add ~5 ml .16% bromocresol green (you can use the bromocresol green from “Rock Bottoms”)
- ❑ Add 1 tsp undiluted dishsoap. The exact concentration or type is not important, as long as bubbles are produced.