

EXHIBIT: ALGAE

ACTIVITY: Bubble Bomb

How is photosynthesis related to baking soda and vinegar?



DISCOVER

A chemical reaction can propel a film canister high into the air or pop a zip lock bag with a bang! Like gasoline and biofuels, baking soda and vinegar were partially formed through photosynthesis. Be an engineer and see what other objects you can move with this reaction.

MATERIALS

For each Film Canister Rocket:

- Film canisters with tight-fitting lids (get them for free at locations that still develop film: Walgreens, Costco, Wal-Mart)
- ½ tsp. baking soda
- 2 tsp. vinegar (white or apple cider)

For each Sandwich Bag Bomb:

- 1 zip lock sandwich bag
- 4-inch square of paper towel
- 1 ½ Tbsp. baking soda
- ½ c. vinegar (white or apple cider)
- ¼ c. warm water

Optional materials:

- Measuring spoons
- Eye dropper

PONDER

- How do the baking soda and vinegar change after they are mixed?
- Is this a physical or chemical reaction? How do you know?
- What would happen if you changed any of the variables?
- Could this chemical reaction be a useful fuel for transportation? List the pros and cons.
- Where do vinegar and baking soda come from? What organisms are involved in their creation?

Grades: 5th-12th

Group Size: 2-4 people per group

Time: 5-20 minutes

Utah Core Curriculum:

- 5th Science 1.3 a, b, c, e
- 8th Science 1.2 b, c; 1.3 a, e; 1.4 a, b; 2.1 a

Process Skills & Higher Level Thinking Skills:

- Observing
- Questioning
- Investigating
- Comparing
- Predicting
- Hypothesizing

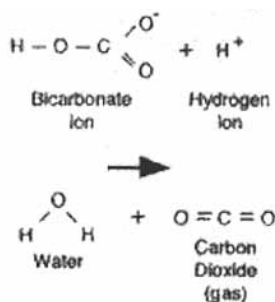
Related Activities/Exhibits:

- Innovation Cloud
- Forces & Motion

WHAT'S GOING ON?

Carbon dioxide and water are produced when baking soda (sodium bicarbonate) and vinegar (acetic acid) react. The buildup of pressure from this gas causes the canister to fly and the bag to pop.

In other words: Sodium bicarbonate + acetic acid \Rightarrow water + carbon dioxide. In chemical form the reaction looks like this (the hydrogen ion is from the acetic acid):



Sodium bicarbonate is made from salt (sodium chloride) and limestone (calcium carbonate). Most limestone is made primarily from the skeletons of marine organisms.

Acetic acid is a product of fermentation. In this process, microorganisms digest the sugars from plants (like apples, in the case of apple cider vinegar). After the microorganisms get the energy they need from the sugars, vinegar is left over.

When a plant undergoes photosynthesis, it is creating sugars from carbon dioxide, water, and sunlight.

Look at the equation above to determine whether the CO₂ in the vinegar and baking soda reaction is from the baking soda or from the vinegar.

EXPERIMENT

Warning: These reactions can fly in all directions. Do the experiments outside and wear safety goggles.

To launch a Film Canister Rocket:

1. Remove the lid of a film canister and pack the center of the lid tightly with ½ teaspoon of baking soda.
2. Pour about 2 teaspoons of vinegar into the empty film canister.
3. Snap the lid firmly onto the canister.
4. Tip the canister over and set it down so that the lid is on the ground.
5. Stand back! (If the canister doesn't shoot up into the air within a few seconds, try another canister with a tighter-fitting lid.)

To make a Sandwich Bag Bomb:

1. Scoop 1 ½ tablespoons of baking soda into the center of a 4-inch square of paper towel. Fold in the paper towel so the powder stays inside.
2. Pour ½ cup of vinegar and ¼ cup of warm water into the zip lock sandwich bag.
3. Carefully keep the paper towel package dry while zipping it inside the sandwich bag. Do this by holding the paper towel through the sides of the plastic bag. After the bag is fully zipped, let the paper towel drop into the vinegar.
4. Stand back and watch the bag expand and pop with a bang!

EXPAND

Experiment: Experiment to see how changes to the canisters or zip lock bags alter the results. Can you alter the canister to make it fly higher, or in a particular direction?

Extend: Can the same chemicals be used to move other types of objects? What if you strap the canister onto a match box car?

Discuss: Is this reaction more similar to photosynthesis or respiration? In photosynthesis, CO₂, water, and light combine to make sugars. In respiration, sugars are broken down into CO₂, water, and energy.

Exhibit: You can apply your newly-acquired knowledge of this type of reaction to The Leonardo's algae exhibit.