



**Science Unit:** *Exploring Chemistry*

**Lesson 3:** *Chemical Changes: Alka Seltzer Rocket*

School Year: 2015/2016

Developed for: Sir Wilfred Laurier Elementary School, Vancouver School District

Developed by: Ingrid Sulston (scientist); Sonia Ko and Sonja Watson (teachers)

Grade level: Presented to grades 3/4/5; appropriate for grades 3 – 7 with age appropriate modifications

Duration of lesson: 1 hour

## Objectives

1. Observe that a new state of matter can be produced by a chemical reaction.
2. Experience how gas pressure can generate a significant amount of force.
3. Manipulate molecular models to understand the chemical reaction powering a toy rocket.

## Background Information

Chemical reactions are all around us, and students may be already familiar with the fizz of bubbles emanating from vinegar and baking soda as they react to form carbon dioxide gas. This lesson encloses this same chemical reaction in a container, so that the gas pressure builds up enough to shoot the container into the air.

## Vocabulary

States of matter: The distinct physical forms that matter can take: solid, liquid or gas.

Molecules and atoms: Tiny particles that make up everything around us. Molecules and atoms are too small to see individually, but with enough of them together they make objects we can see. Two or more atoms are bonded together to make a molecule.

Chemical reaction: A chemical reaction occurs when molecules break apart and their atoms rearrange to make new molecules. Sometimes the new molecules are a different state of matter, so the chemical reaction involves a state change.

## Materials

- film canisters, or small snap-top small containers e.g. dollar store (one per student)
- Alka Seltzer tablets broken in half (one half per student)
- water in a squeeze bottle
- waste container
- molecule model kits, each containing three red oxygen atoms, two white hydrogen atoms, one black carbon atom and six bonds (one per small group or pair of students)



## In the Classroom

### Introductory Discussion

1. Show students what happens when an Alka-Seltzer tablet is dropped in water (bubbles are made). Ask them what would happen if we confine this chemical reaction in a small container [Explode!]
2. Brief description of science activities in this lesson:
  - Alka-Seltzer rocket: use the chemical reaction between Alka-Seltzer tablets and water to project a film canister into the air.
  - Molecular modelling of Alka-Seltzer rocket: use molecular models to figure out the chemical reaction that makes the Alka-Seltzer rocket fire.
3. Processes of science that the students will focus on: curiosity, mechanical manipulation, inferring, concluding, predicting.
4. Safety guidelines: although these rockets do not have much power, do not hang your head over them when they might take off, or eye injury may occur.

## Science Activities:

### A. Alka-Seltzer rocket

Purpose of Activity: To observe that a chemical reaction can generate enough power to fire off a small rocket.

Methods and Instructions:

Students will work in one large group.

1. Take the students outside to an open area.
2. Tell students that they will add water and Alka-Seltzer to their film canister, cap it, then stand back.
3. Organize students so that they each hold a film canister, then help them half fill their canister with water from the squeeze bottle. Give them each half a tablet to hold in the lid. They should keep the tablet and water separated until asked to step forward. Ask all students to stand on a line at the edge of the working area.
4. In small groups, pull students out of the line, then ask them to drop their half-tablet into their container of water, then immediately snap the container closed, then hand it to the teacher. The teacher places each container on the ground with the lid downwards before standing back, or older students can do this themselves. (If they go off before the person can retreat, the force is not so powerful as to be dangerous - just be sure to keep eyes averted.)
5. Discuss why the rocket was propelled upwards: the chemical reaction between the water and the Alka-Seltzer made a gas. As the gas built up inside the film canister, the pressure increased. Eventually the pressure was great enough to force the lid off. This downwards force of the gas and water escaping from the canister generates an equal and opposite reaction (Newton's Law) that pushes the container upwards. It will go up to 5m high.



## B. Molecular Modelling of Alka-Seltzer Rocket

### Purpose of Activity:

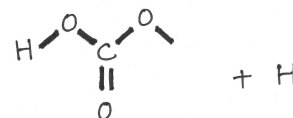
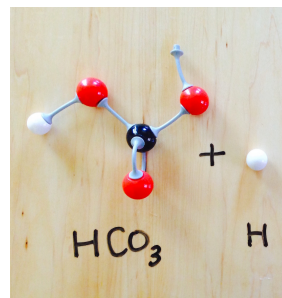
To understand how atoms reorganize in a chemical reaction to make new products.

### Methods and Instructions:

Students will work in pairs or small groups.

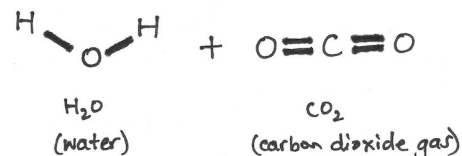
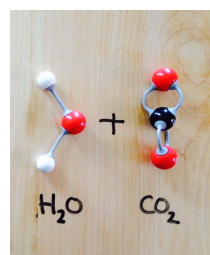
1. Distribute the molecule model kit to each pair of students.

Show students models of the molecules in an Alka-Seltzer tablet ( $\text{HCO}_3$  molecule, left in the photo and drawing, and H atom, right in the photo and drawing). Ask students to assemble these two structures from their kit.



H = hydrogen atom    C = carbon atom  
O = oxygen atom    - = bond

2. Tell students that when water dissolves the Alka-Seltzer tablet these two molecules can mix together. They chemically react and their atoms rearrange to make new molecules. One of the new molecules is a gas (seen and tasted as the bubbles and fizz in the soda). The other new molecule is water.



3. Ask students to pull apart their  $\text{HCO}_3$  and H, then reorganize them to make a water molecule ( $\text{H}_2\text{O}$ ), and then use the remaining atoms and bonds to make the new gas molecule. This new molecule uses up all the atoms and bonds.
4. These are the molecules that students should arrive at:  $\text{H}_2\text{O}$  (water) (left in the photo and drawing), and  $\text{CO}_2$  (carbon dioxide), the new gas molecule. (right in the photo and drawing). They may need prompting to fill all the holes in the atoms so that the  $\text{CO}_2$  has double bonds.
5. Once all the students have made their molecules, summarize what they just did and how this relates to their film canister rocket: in the film canister, the water dissolved the molecules of the Alka-Seltzer tablet so that they could mix together and chemically react. During the chemical reaction, the atoms reorganized to make two new molecules. One was water, which mixes in with the other water. The other new molecule is carbon dioxide, which is a gas. As more and more carbon dioxide gas is produced by the chemical reaction, the gas pressure inside the film canister builds up, until the pressure is too great and the lid pops off and the rocket shoots up.

### Closure Discussion

This activity investigated a common chemical reaction, where baking soda and an acid (anything containing H atoms, like vinegar or a sour juice) make water and carbon dioxide gas. You can repeat this chemical reaction at home, using vinegar and baking soda which you probably have in your kitchen.