Name: _____

Lesson 1
Production of a gas

STUDENT ACTIVITY SHEET

Meet the scientist

Country: Republic of Iceland
Scientist: Victor Helguson

Welcome to Iceland! My name is Victor Helguson, and I am a volcanologist. I study volcanoes. I try to predict when the next eruptions will happen. This is an important job in Iceland. We have about 130 volcanic mountains here. And that's in a country the size of Kentucky!

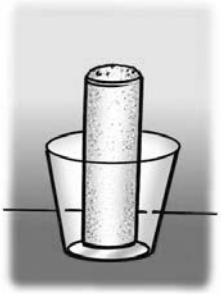
To better understand volcanoes, I study the magma inside them and the lava that comes out. I also collect gases that volcanoes emit. Carbon dioxide (CO_2) is one of the main gases that seep out of active volcanoes. Certain changes in these gas emissions can be a sign that a volcano is set to blow.

When a volcano here in Iceland erupted in 2010, it produced so much ash that airports across Europe had to shut down. There was just too much ash in the air for planes to safely fly.

Producing a gas can be very useful, especially if you can control the amount that you make. In the activity, you will make your own CO_2. After the activity, you will see one way that using a chemical reaction to produce a gas can save lives!

Activity

How can you make just the right amount of foam so that it rises all the way to the top of your vial without overflowing?



The rules

Keep the amount of water and detergent the same but try a different amount of citric acid or baking soda or both. A dome of foam at the top of the vial is OK, but the foam shouldn't drip down the vial.

You will need

- Goggles
- Citric acid
- Sodium bicarbonate
- Detergent solution
- Water
- Small metric measuring cup
- Dropper
- 2 small plastic scoops
- 2 small clear plastic cups
- Clear plastic vial

Scoop

Procedure

1. Decide on the number of scoops of citric acid and sodium bicarbonate you will combine, and write it in the chart on the next page.
2. Measure 5 milliliters (mL) of water and pour it into a small plastic cup.
3. Add the number of scoops of citric acid your group agreed on and swirl.
4. Add 1 drop of detergent solution and swirl.
5. Place the number of scoops of sodium bicarbonate your group agreed on in the plastic vial and stand it up ina cup as shown.
6. Pour the citric acid and detergent solution into the vial so that it mixes well with the baking soda.

Make foam rise to the top without overflowing

	Demonstration	First try	Second try	Third try
Water	5 mL	5 mL	5 mL	5 mL
Citric acid	1 scoop			
Detergent	1 drop	1 drop	1 drop	1 drop
Baking Soda	1 scoop			
How close did the foam get to the top of the cylinder?	Foam rises part way up			

The big chemistry idea

In the chemical reaction in this activity, the citric acid and the sodium bicarbonate are called *reactants*. The carbon dioxide gas and other substances that are produced by the reaction are called *products*. The citric acid and sodium bicarbonate are made of atoms. In the chemical reaction between these reactants, certain atoms come apart from one another and rearrange to form the gas and the other substances in the products. When more reacting substances are used, there are more atoms to create more products.

Real-world application

Chemical reactions that produce gases can make our lives better and safer. One example is the gas that inflates an air bag during a collision. Scientists have figured out a way to make this chemical reaction go super-fast to save lives in a car crash.

Traveling at high speeds, cars are seriously dangerous places to be during an accident. That's why many vehicles have seat belts and airbags. When two cars collide, passengers are often thrown forward and can become badly injured. Airbags are like large balloons. When they inflate, they prevent people from hitting the hard inside parts of the car. In order for airbags to work, however, they have to be fast. *Really* fast. That's where chemistry comes in.

Airbags are connected to a crash sensor, which has a built-in accelerometer that senses a sudden shift in the car's speed. When the crash sensor detects rapid deceleration, the airbag inflates with nitrogen gas at 200 MPH—faster than the blink of a human eye! In this case, nitrogen forms through a reaction between two chemicals called sodium azide and potassium nitrate. The entire process of airbag deployment takes just $^{1}/_{25}$ of a second. After the airbag inflates, nitrogen gas eventually escapes through very small holes in the airbag material, allowing the passenger to safely exit the vehicle.