

Balloon Blow Up

Summary: When natural gas is transferred through pipelines, it is pressurized so it takes up as little space as possible. Gas molecules take up more space than molecules for solids or liquids because they are farther apart from each other. You can see how gas can take up lots of space with this cool experiment.

Estimated Time: 15 - 20 minutes

MATERIALS NEEDED:

1 .5 L (16.9 oz) clean, empty, plastic soda bottle
1 balloon
1 tsp baking soda
2 tbsp vinegar
2 spoons or funnels
paper towels (for cleanup)



Safety Notes: Protective eye wear is recommended in case the balloon explodes. Never point the bottle and balloon at anyone. We do not recommend ingesting any materials. Balloons should stay away from mouths as they can cause choking. **Be sure you have adult supervision during this activity!**

Procedure:

- Place the bottle on the table and remove the lid. Carefully pour or spoon 2 tablespoons of vinegar into the bottle.
- Open up the mouth of the balloon (put the first two fingers, not the thumb, on each hand inside the mouth of the balloon and stretch). Have a friend put 1 teaspoon of baking soda into the balloon with the spoon you have *not* used. Or you can use a funnel to add the baking soda a little easier.
- Without spilling any of the baking soda, stretch the mouth of the balloon over the mouth of the bottle.



- Turn the balloon completely upright so that the baking soda inside the balloon pours into the bottle with the vinegar. Watch!



- What is happening inside the bottle?
- What is happening to the balloon? Why? How do you know?

Think About It:

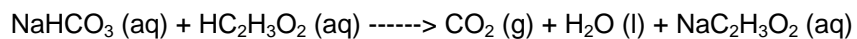
Elementary Level:

Baking soda is a chemical called sodium bicarbonate and it reacts with vinegar. Vinegar is called acetic acid. These two chemicals react and form something new. You can see that a reaction is happening. What things happened? The baking soda and vinegar fizzed and you may have seen some bubbles. The bottle probably feels cool around the mixture. The balloon blew up. All of these observations tell us that a reaction occurred.

Scientists know a lot about what makes up baking soda and vinegar. They wrote an equation that tells us what is made when we mix them. One of the things that is made is carbon dioxide gas. How could we see the carbon dioxide? It blew up the balloon. We captured the carbon dioxide inside the balloon. We see the space it takes up.

Middle School/High School Level:

Vinegar ($\text{HC}_2\text{H}_3\text{O}_2$) is a solution of acetic acid. It reacts with baking soda, sodium bicarbonate (NaHCO_3), to produce carbon dioxide gas (CO_2) and an aqueous solution of sodium acetate ($\text{NaC}_2\text{H}_3\text{O}_2$). The reaction can be written as follows:



The carbon dioxide filled up the balloon, causing it to expand. We saw the volume change caused by the carbon dioxide in this activity. What might have happened if we had capped the bottle off, leaving no place for the carbon dioxide to go? It would have built up pressure because carbon dioxide takes up space. Why do you think the bottle felt cold? The reaction needs heat to make it happen so it takes heat, leaving the bottle feeling cold. A reaction that needs heat to make it happen is called endothermic. How did you know that your reaction finished? What might have caused the reaction to stop? Your reaction stops when you run out of reactants. The reactants are the things on the left of our reaction equation above. Our reactants were baking soda and vinegar. When one of these is used up completely, the reaction will stop.

Teaching Tips:

- Typically we have students complete this activity in groups of 2-4. The baking soda and vinegar fit nicely into 2-oz plastic cups. You can get these at school supply stores, craft stores or food stores. The containers we use are called ramekins and come with plastic lids. These are great because things can be portioned ahead of time and stacked. We recommend that you pre-measure ingredients for young students.
- The amounts of baking soda and vinegar are approximate and depend on the bottle used. If a larger container is used, increase the amounts of baking soda and vinegar.
- If the balloon does not begin to expand right away, shake the soda bottle slightly to mix the baking soda and vinegar.