LESSON 4:
INFLATING BALLOONS

Students will experiment with the reaction of baking soda and vinegar by creating carbon dioxide to inflate a balloon.

OBJECTIVES

- [x] What happens when vinegar and baking soda mix?
- [x] How do balloons inflate?
- [x] Does the amount of vinegar and baking soda correlate to the amount of carbon dioxide produced?
- [x] What is the evidence that a chemical reaction has occurred?

SUPPLIES

- 6 clear plastic water bottles (empty)
- 1 bottle of vinegar
- 1 box of baking soda
- 12 balloons
- 12 pieces of paper and 12 pencils
- 3 funnels
- Measuring spoons

HOOK

3-5 min

Blow up a balloon in front of students. Ask students:

- What is inside the balloon? How does it inflate?
- Explain that you breathe in oxygen and breathe out carbon dioxide. The balloon is filled with carbon dioxide.

HYPOTHESIS

3-5 min

Discuss this first question orally:

- How could we get the balloon to inflate using the materials visible (water bottle, baking soda, vinegar, and balloon)?

Help students to recall from the last lesson that baking soda and vinegar create carbon dioxide. This is used to inflate a balloon. Then, have the students copy down or create a chart like the scientist worksheet. Then, using the information from the hook, have them predict:

- How long does it take for a balloon to inflate using a chemical reaction?
- Does the amount of vinegar and baking soda affect the amount of carbon dioxide produced?
- Does swirling the bottle make the balloon inflate faster or slower?

KEYWORDS

- Acid
- Base
- Carbon Dioxide
- Catalyst
- Gas
- Inflate

LESSON 4

CHEMICAL REACTION

A chemical reaction is where different substances (reactants) are changed into a new substance (product)

SIGNS

- change of color
- change of temperature
- change of smell
- production of gas
- production of a solid
- emission of light

EXPERIMENT

20-25 min

1. Split students into teams of 3 or 4.
2. To start, have each group begin by filling one water bottle 1/3 of the way with vinegar (about 1/4 cup).
3. Then, have the students use the funnel to add 2-3 teaspoons of baking soda to the balloon. It is helpful if one student holds the balloon, another holds the funnel and the third adds the baking soda. The baking soda should rest in the top of the balloon, away from the end you use to blow it up.
4. Carefully, without spilling any of the baking soda, attach the balloon to the water bottle. Hint: One student can pinch the balloon, sealing the baking soda in, while another uses the open end of the balloon to attach it to the bottle.
5. On the count of three, have one group member lift the balloon, allowing the baking soda to fall into the water bottle with vinegar.
6. Assign 1 or 2 groups to whirl the balloon and the other 1-2 groups to keep it steady. Compare results.
7. Have children observe what happens to the balloon.
8. Finally, students will use their second water bottle and repeat the experiment. This time, they can increase the amount of baking soda used. Students will time this experiment and observe what happens when these amounts are changed.

Note: Monitor the amount of baking soda is added, otherwise the balloons will pop!

LESSON 4

OBSERVATION

5-10 min

Ask students to discuss:

- What happened when the baking soda and vinegar mixed?
- Which experiment took the longest to inflate? Which took the shortest amount of time?
- Which experiment produced the biggest balloon?

Students should note that when the baking soda was added, the mixture fizzed, and the balloon began to inflate. When students added more baking soda, the balloon should have taken longer to inflate. When students swirled the bottle, it should have taken the shortest amount of time to inflate. The biggest balloon should have been created when more baking soda was added.

CONCLUSION

3-5 min

Ask students to share their findings.

- What impact did swirling the bottle have?
- What impact did changing the baking soda have?
- Why did the balloon stop inflating?

Swirling the bottle should have sped up the reaction, causing the balloon to Inflate quicker. Increasing the amount of bicarbonate of soda should have made the balloon inflate to a larger size and should have increased the time it inflated for. The balloon stopped inflating when the mixture stopped fizzing.

EXPLANATION

5-10 min

When the baking soda and vinegar combine, a chemical reaction occurs. Vinegar is an acid and contains hydrogen ions. Baking soda is a base and contains sodium and bicarbonate ions. When vinegar and baking soda combine, they react, and the ions change to form new substances. As a result, carbon dioxide is formed, creating bubbles and foam.

The carbon dioxide began to Inflate the balloon when it was produced because the balloon was sealing the bottle. When the carbon dioxide gas filled the bottle and ran out of room, it began to fill the balloon. Swirling the bottle acted like a catalyst to speed up the reaction. Swirling the bottle made the bicarbonate of soda and vinegar mix at a more rapid speed, increasing the speed at which the carbon dioxide was produced.

When more baking soda was added to the balloon, there was a larger chemical reaction because there was more hydrogen, sodium, and bicarbonate ions reacting, thus making more carbon dioxide. When the mixture stopped fizzing, the ions have reacted, and a new substance was formed. There was no longer an ongoing reaction, so no further carbon dioxide was produced. Therefore, the balloon no longer inflated.

LESSON 4

EXTENSION 5-10 min

If you have extra time, have students blow up one balloon, as quickly as they can, timing their try. Who is faster at blowing up the balloon, a person, or a chemical reaction?

CLEAN UP & DISMISSAL

Students must then clean their workspace. Dispose of the liquids carefully. Make sure to leave the classroom the way you found it.

SCIENTIST'S WORKSHEET

Tip: Can draw or write the following down on whiteboard!

	Hypothesis - How long do you think it will it take to inflate?	Hypothesis - Size of the balloon (Large, medium, or small)	Observation - How long does it take to inflate?	Observation - Size of the balloon (Large, medium, or small)
2 teaspoons of bicarbonate of soda, no swirling				
2 teaspoons of bicarbonate of soda, swirling				
_?_ teaspoons of bicarbonate of soda, no swirling