

Project Exploration creates transformative learning opportunities for youth underrepresented in the sciences –particularly students of color and girls – by equipping them with the skills, practices, and mindset needed for a lifelong pursuit of learning. STEM@Home makes activities around science, technology, engineering, and math accessible and fun to do at home. This STEMbook activity, resources, and more are available at [www.projectexploration.org/stemathome](http://www.projectexploration.org/stemathome).

## In this activity, you will:

Follow the steps of the scientific method to determine the effect of temperature on gases.

## Supplies Required:

- Graphic organizer
- 3 Latex balloons
- 1 Thermometer
- 1 Permanent marker
- 1 Measure tape (millimeters)

## Video

Learn about the properties of gases: <https://tinyurl.com/yyhokbla>

## Overview

Everything in the world around you is made up of matter, including the balloon you have and what's inside it. Matter comes in different forms, called states. The states, going (generally) from lowest energy to highest energy are solids, liquids, and gases. Gases, like the air inside your balloon, take the shape of the containers that they are in. They spread out so that all the space is filled up evenly with gas molecules. Gas molecules move fast and travel around in a space. The combined motion energy of all of the gas molecules in a container is called the average kinetic energy.

This average kinetic energy (energy of motion) changes in response to temperature. When the temperature increases, the average kinetic energy of the gas molecules also increases. The molecules move faster and have more frequent and harder collisions with the inside of the container. So, when your balloon is at room temperature, it was plump and full. When the balloon was put into cold air, though, the average kinetic energy of the gas molecules was lowered, so the collisions of the molecules with the inside wall of the balloon became less frequent and weaker, making your balloon saggy.



## Instructions

1. Use the graphic organizer to guide you through the scientific method.
2. STEP 1: Problem: What do we want to solve? How does temperature affect the gas inside of a balloon?
3. Even though we cannot see it, when we blow up a balloon, we are forcing carbon dioxide gas (what we exhale) into the balloon. The balloon expands as it is filled with gas. Gas has an indefinite volume, meaning that it will fill whatever space or container it is in.
4. STEP 2: Hypothesis: Make a prediction! If we increase the temperature of the gas around the balloon, what do you think will happen?
5. STEP 3: Experiment: Test it out and make observations!
6. Blow up one of the balloons until it is full, but not close to popping, and tie it.
7. Mark the balloon with the number 1.
8. Measure the circumference of this first balloon with the tape measure, selecting the fullest part of the balloon to measure.
9. Blow up the second balloon so it looks about the size of the first balloon, but do not tie it off yet. Pinch the opening closed between your thumb and finger so the air can not escape. Have your helper measure the circumference of the second balloon, just as you measured the first balloon. Adjust the air in the second balloon until its circumference is the same as the first.
10. Tie off the second balloon and mark it with the number 2.
11. Repeat step 4 for the third balloon, adjusting the circumference until it is the same as the others.
12. Take the temperature of all three balloons.
13. Place one balloon in a hot area, one in a warm area, and one in a cold area. Wait 10 minutes.
14. Take the temperature of all three balloons again and measure their circumference.
15. STEP 4: Analysis: Based on your observations what do we now know? What happened to each balloon? Why do you think that happened? What can you infer about different temperatures in relation to gas?
16. STEP 5: Conclusion: Was your hypothesis correct or incorrect?

## Additional Resources

1. Learn about phase changes: <https://tinyurl.com/h62whvz>
2. Watch what happens when you use liquid nitrogen on a balloon! <https://tinyurl.com/ybxw5f2q>

## Share It Out

**Share on social media:** Share the results of your experiment with your friends and family on social media! Explain the steps of the scientific method in a video! Use the hashtags:

#ScientificMethod  
#ProjectExploration  
#StemAtHome

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