

Hot Air

Activity Summary

This demonstration and activity illustrate how air density changes when it is heated, helping to explain how wind is caused when the Sun heats the Earth.

- Class time: 30 minutes
- Grade level: K-5. Modify for PreK by demonstrating one black bottle and one white bottle for them, then omit the rest of the activity and any mention of *density* and *molecules*.

Learning Objectives

- The Sun provides heat and light.
- Heat/Cold differences cause wind.

Materials Needed

- Empty water/beverage bottles of different sizes and shapes. At least two should be the same size and shape.
- Balloons that fit snugly over the empty bottle spouts, in assorted colors
- Black and white material to cover the bottles, such as duct tape or paint
- Heat emitting lamp (such as a spotlight)
- Card stock or cardboard of assorted colors
- Clear plastic container with a lid
- Enough ping pong balls to fill half of the container
- Rulers
- Pencils
- Paper for collecting data
- Cold storage such as refrigerator or ice chest with cold packs

Preparation

Cover half of the bottles with black material and the other half with white. For bottles that are the same size and shape, make sure to have at least one black and one white. Put a balloon over one bottle spout. Keep the balloon bottles cold until just before the demonstration and/or activity.

Demonstration

1. Show a balloon bottle with a deflated balloon.
2. Ask them what heats the air outside (the Sun).
3. Explain that the heat emitting lamp represents the Sun. Place the balloon bottle in front of the lamp and turn it on.
4. Within a minute the balloon will stand up straight, partially inflated.

To help explain this, show students the clear container with the ping pong balls. When air is cold, the molecules (smallest pieces of air) are close together and don't take up much space. A relatively small space has a lot of pieces of air, making it heavy for the small amount of space that it is occupying (more dense). When the molecules are heated, they bounce around instead of staying close together. Shake the container with the ping pong balls rigorously. The same number of air pieces or ping pong balls take up more room as a result, weighing the same amount in a larger space (less dense). The cold air is more dense and sinks, pushing the less dense warm air up and out of the way.

Activity

Students work in groups to inflate more balloon bottles while manipulating variables. Present all the items at once, without explanation, and let them decide which bottles to test and what their variables will be. If possible, cool the bottles between tests, letting students use that time to write or draw about them. Possible variables include:

- Size and shape of the bottle
- Color of the bottle
- Color of the balloon
- Presence of a background (card stock or cardboard) under or next to bottles
- Color of any background
- Distance from the light source.



Encourage participants to measure and collect data on the results of the experiments and share the results. Ask them questions such as the following:

- *How big did the balloon get?*
- *Which variable(s) turned out to be the most important?*
- *Why do you think this happened?*