4-H Grab and Go:
Air Pressure

Concept:
Temperature can cause changes in air pressure.

Age Level:
Middle School: Grades 5-8

Education Standard:
NSES – Physical Science, History and Nature of Science

SET Ability:
Observe, interpret, analyze

Life Skill:
Acquiring and evaluating information

Success Indicator:
Youth will be able to take notes/draw pictures of observations and describe evidence of changes in air pressure caused by changes in temperature.

National 4-H Curriculum:
The Power of the Wind (www.4-H.org/curriculum/wind)

PREPARATION

Time: 5 minutes

Space:
Access to electricity, tables

Materials:
- Blow dryer
- Plastic water bottles
- Tub of ice or freezer

Background Information

Temperature changes cause air pressure changes, and changes in air pressure causes wind. When air is heated the molecules spread apart and it rises. When air is cooled molecules move together and it sinks. Cool air, in areas of high pressure, rushes in to replace warmer air in areas of low air pressure. This rush of air produces wind.

Try this experiment to see how changes in air pressure works:

Instructions

1. Use a blow dryer to blow warm air inside an empty water bottle or hold an empty, open water bottle under warm, running water for several minutes.
2. Quickly, put the lid on the bottle. Make sure it is tight.
3. Place the bottle in the freezer or tub of ice for several minutes.
4. Remove the bottle from the freezer or ice.
5. What do you observe? What happened to the bottle? Why do you think this happened?
6. Hold the bottle upside-down with the lid under water in the large bowl of water.
7. Then remove the lid with the opening of the bottle under water. What happens? How can the change in air pressure explain this?

Air Pressure

LEARN MORE

Learn how air pressure affects you at NASA's "For Kids Only" site http://kids.earth.nasa.gov/archive/air_pressure/

The National Weather Service Online Weather School has more information about air pressure at http://www.srh.noaa.gov/jetstream/atmos/pressure.htm

University of Illinois's Weather World 2010 integrates current and archived weather data with multimedia instructional resources. This site gives more in depth information about air pressure. http://ww2010.atmos.uiuc.edu/(Gh)/guides/mtr/fw/prs/def.rxml

AIR FACTS

- More than half of the air molecules in the Earth's atmosphere are within the first 5.5 km (3.4 miles).
- A large volume of air having consistent temperature and humidity is called an air mass.
- When air pressure is low the probability of stormy weather is increased.
- Barometers measure air pressure. The measurement unit is millibar (mb). At sea level normal air pressure is 1013.25 mb.

Extension

1. Predict what will happen when the experiment is reversed.

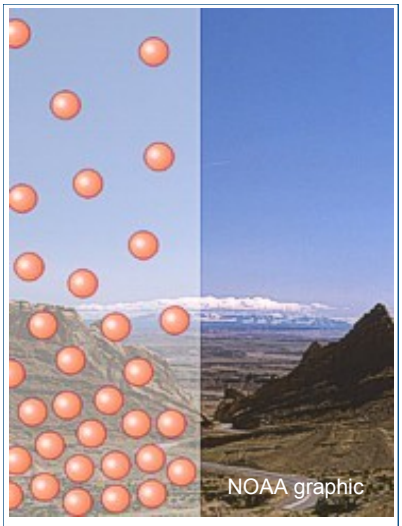
- Test your prediction. Put the bottle in the freezer or tub of ice for about ten minutes without the lid. Then quickly put the lid on tightly and place the bottle under hot water or use the blow dryer to heat the bottle for several minutes.
- What happens?
- Was your prediction correct?

2. Predict what will happen if you take the lid off under water.
   - Explain your thinking.
   - Test your prediction.
   - What happens?
   - How was your prediction supported or challenged?

3. Try squeezing the water bottle at different times during the experiment and feel how it changes.
   - Can you predict when it will feel full and tight?
   - Can you predict when it will feel empty?

More

Air pressure is lower at higher altitudes. You may have noticed a change in air pressure when you go up in an elevator or travel up a mountain. Baking at higher altitudes requires adjustments in ingredients and baking time.



On Earth as elevation increases, the number of air molecules decreases. Air with fewer molecules is less dense and air pressure is less.