



Build Your Own Barometer

In this exploration, students will create a model that measures the atmospheric pressure of their climate, record their observations, and interpret how this model can be used to determine air pressure. In addition, students will hypothesize how they can track weather using their weather devices and study atmospheric pressure.

Driving Questions

- How does the uneven heating of Earth's surface cause changes in atmospheric pressure?

Material

- Small glass jar or tin can
- Large (12") round balloon or clear plastic wrap
- Rubber band
- Scissors
- Tape
- Small stirring stick
- 5" x 7" index card
- Student copies of Barometer Simulation Instructions (see Step 1 to decide how many copies)
- Barometer Visualization - Teacher Copy
- Student copies of:
 - Student Observation Sheet
 - Student Analysis Sheet

Key Vocabulary

- Atmospheric Pressure
- Weather
- Barometer

Engage - Class Brainstorm

1. Initiate a discussion about pressure by posing the following series of questions to the class:
 - a. *Why do your ears hurt when you dive deep underwater?*
 - b. *Why do our ears "pop" when we fly in an airplane?*
 - c. *Other than air, what are some examples of things that exert pressure?*
2. Ask the class to discuss the question(s) and and share responses as a group. Jot their thoughts down on chart paper or on the board.

Explore - Barometer Design Procedure

1. Decide how you want to run the simulation. You can put students in small groups of 3-4 and provide each with a set of barometer materials and 1 page of Simulation Instructions, **OR** you can do the demonstration yourself for the whole



class and provide each individual student a copy of the Simulation Instructions.

2. Read the Barometer Simulation Instructions aloud with the class and conduct the Barometer Simulation first.
3. Have students record the barometric pressure from their devices daily inside *and* outside for one week. They should record the distance from the origin on the scale card (ex. +2mm or -2mm) as well as whether that measurement is indicative of rising pressure (High) or falling pressure (Low).
 - a. If possible, look up the actual barometric pressure for the day in mmHg.

Explain - Daily Barometric Pressure Examination

1. Provide each student with a copy of the Daily Barometric Pressure sheet. Review the task as explained on the Barometer Simulation Instructions.
2. Discuss with students how their models will work:
 - a. **Ask:**
 - i. *What will high pressure do to the balloon? Why?*
 1. High pressure will push in on the balloon and the cover will be pushed inward, causing the straw-arrow to point up.
 - ii. *What will low pressure do to the balloon? Why?*
 1. Low pressure will cause the balloon to puff out, causing the straw-arrow to point down.
 - iii. *Who might use a barometer in their work?*
 1. Meteorologists, coast guard, pilots, gardeners, etc.

Elaborate - Student Analysis Sheets

1. Based on the table they filled out, give students time to finish the questions on the Analysis Sheet to explain their responses.
 - a. Use student responses to guide a class discussion about the results.
2. Push student thinking by extending their thought with the following question:
 - a. *If the eye of a hurricane passed directly over the school, how would it affect the air pressure on their barometers? Why do you think so?*

Evaluate

1. Use student responses on Analysis Sheets to gauge student understanding of the interaction between high and low pressures systems.



Barometer Simulation - Instructions

We may not be able to feel it, but the air, or **atmosphere**, that surrounds Earth has weight. After all, air is not empty. It is made up of oxygen, nitrogen, hydrogen, and carbon dioxide molecules. Gases may seem weightless, but in large amounts the weight of these molecules pushes down on everything below it. Add to that mixture a variable amount of water vapor, and you can see how the miles of air above the earth's surface exerts a force on the earth below.

The weight of air above a given area on Earth's surface is what we call **atmospheric pressure**. It is an important factor influencing Earth's weather and climate. Atmospheric pressure, defined as the force per unit area exerted against a surface by the weight of the air above that surface, can be measured with an instrument called a barometer. Atmospheric pressure is a key indicator of **weather**. High-pressure systems usually lead to fair, calm, and steady weather. When a low-pressure system moves into an area, it usually leads to cloudiness, wind, and precipitation. In this experiment, we will be constructing our own barometer in order to measure the atmospheric pressure in our region, and infer its effects on the weather.

Procedures

Step 1 - Use the scissors to cut the top of the balloon off.

Step 2 - Wrap the top of the balloon tightly around the opening of the jar or can and seal it with the rubber band. Try to get the balloon (or clear plastic wrap) as tight as possible and make sure that the rubber band is tight enough so that no air will get in.

Step 3 - Tape the stirring stick to the center of the stretched out balloon so that one end of the stick points away from the jar or can.

Step 4 - Place the jar or can next to a wall. Tape the index card to the wall so that the end of the stick is pointing to it.

Step 5 - Make a mark on the index card next to where the stick is pointing as the origin (0). You may wish to label the mark with the date and time. When students are making the scale, make sure they note that the changes in pressure are small so they will need centimeters and millimeter units on the scale bar.

Label the units on the scale bar as +/- from the origin. (i.e. -3, -2, -1, 0, +1, +2, +3)

Step 6 - Look at the card each day and see if the stick points above or below where it did the day before. If it points above the previous day's mark, the pressure is rising. If it points below the previous day's mark, the pressure is falling.



Barometer Visualization - Teacher Copy





Student Observation Sheet

Why does air pressure influence the weather in a region?

Hypothesis: _____

Day 1

My Barometric Pressure	Actual Barometric Pressure

1. What was the weather like? How did it feel?

Day 2

My Barometric Pressure	Actual Barometric Pressure

2. What was the weather like? How did it feel?



Day 3	
My Barometric Pressure	Actual Barometric Pressure

3. What was the weather like? How did it feel?

Day 4	
My Barometric Pressure	Actual Barometric Pressure

4. What was the weather like? How did it feel?

Day 5	
My Barometric Pressure	Actual Barometric Pressure

5. What was the weather like? How did it feel?



Student Analysis Sheet

1. Why do you think atmospheric pressure is lower when the air is warmer?

2. Why do you think atmospheric pressure is higher when the air is cooler?

3. Why do you think weather is more dynamic and changing when the atmospheric pressure is low? Support your answer with strong reasoning.

4. Why do you think weather conditions are more constant, stable, and clear when atmospheric pressure is high? Support your answer with strong reasoning.
