Atmospheric Pressure & Build a Barometer

Grade Level: 8th Grade

Duration: 1 week (one 45 min lesson to build, than collect weather report for a week to scale the device).

Objectives: Students will be able to:

- build a model that measures atmospheric pressure
- interpret how this model can be used to determine air pressure
- investigate air pressure, track weather using their weather devices
- calibrate their devices based on daily weather report

Next Generation Science Standards (NGSS)

MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.
MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Common Core Mathematics Standards

MP.2 Reason abstractly and quantitatively.
CCSS.Math.Content.7.G.A.1 Solve problems involving scale drawings of geometric figures, including computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.
CCSS.Math.Content.6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems, e.g., by reasoning about tables of equivalent ratios, tape diagrams, double number line diagrams, or equations.

Common Core Mathematical Practices

1. Reason abstractly and quantitatively.
2. Model with mathematics.
3. Use appropriate tools strategically.
4. Attend to precision.

Common Core ELA Standards

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

Materials Needed:

1. 2 liter plastic bottle.
2. Ruler (30cm)
3. Scotch Tape
4. 40 cm of clear plastic tubing
5. Clay
6. Water with food coloring

Lesson Summary:

Main objective of this lesson is students to be able to build a functioning barometer. The Math integration of this lesson involves students collecting mathematical data of daily atmospheric pressure of their city, designing a measurement scale for their barometer, and scale their barometer's measurement according to real data. Building barometer will take 45 min lesson. Students will continue collecting daily atmospheric pressure data (www.weather.gov) of their region for a week while marking changes on their device. Students will scale their device in ratio with the real life data.

Engage	**Demonstration:** Students will watch a short video about the air pressure. https://www.youtube.com/watch?v=p3b9pK-O6cE **Probing Questions:** What makes the metal container collapse? How can we detect the atmospheric pressure changes?
Explore	Working in groups of 2, students will build their barometer. Instructions Take an empty 2 litre plastic bottle. Cut off the top of this bottle. Begin by standing the ruler in the bottle. Tape the ruler to the outside of the bottle. Make sure that the numbers on the ruler are visible through the bottle. Stand the plastic tube inside the bottle. Tape the tube to the bottle, but make sure that the tube is not touching the bottom of the bottle – raise it by a couple of cm. As tape will not stick well under water, make sure that the tube is mainly secured higher up. It doesn't matter if the tube is not very straight. Fill the bottle about halfway with water. Use the plastic tube like a straw and draw some water halfway up the tube. Use your tongue to trap the water in the tube. Quickly move the clay onto the top of the tube to seal it. Make a mark on the outside of the bottle to record where the water level is

	in the tube. Each time you notice a change in the water level, make another mark. You'll notice, over time, that the water level rises and falls.
Explain	The water in the tube rises and falls because of air pressure exerted on the water in the bottle. As the air presses down (increased atmospheric pressure) on the water in the bottle, more water is pushed into the tube, causing the water level in the tube to rise. When the air pressure decreases on the water in the bottle, some of the water will move down out of the tube, causing the water level in the tube to fall. The change in barometric pressure will help you to forecast the weather. Decreasing air pressure often indicates the approach of a low pressure area, which often brings clouds and precipitation. Increasing air pressure often means that a high pressure area is approaching, bringing with it clearing or fair weather. Watch the video for an alternative model of homemade barometer, and understanding low-high air pressure: https://www.youtube.com/watch?v=jmQ8FWnM0fA
Elaborate/Extend	Visit www.weather.gov to find out what the actual pressure is where you are. Collect actual barometric pressure, and record on your data table. Each day, mark pressure changes on your own barometer. After one week data collection, compare data obtained from weather.gov with your device markings. Finalize your devices scale based in ratio to real data.
Evaluate	- Working model of students barometer - Data collection table of daily barometric pressure from weather.gov - Barometer has a scaled measurement unit

References

Air Pressure explained [Video file]. (2011, June 1). Retrieved from https://www.youtube.com/watch?v=jmQ8FWnM0fA

atmospheric pressure - MY NASA DATA. (n.d.). Retrieved from https://mynasadata.larc.nasa.gov/glossary/atmospheric-pressure-2/

Imploding Drum [Video file]. (2011, September 6). Retrieved from https://www.youtube.com/watch?v=p3b9pK-O6cE

Make a Barometer | Royal Meteorological Society. (n.d.). Retrieved from https://www.rmets.org/weather-and-climate/observing/make-barometer

National Weather Service. (n.d.). Retrieved from https://www.weather.gov/