

Under Pressure

Estimated Time: 60 minutes

SUMMARY

In this activity, kids learn about air pressure and how it affects the weather. Kids make their own barometer, track air pressure data, and then forecast the weather by both reading weather charts and using their barometer. Kids also learn how clouds are formed and make clouds.

WHAT YOU'LL LEARN

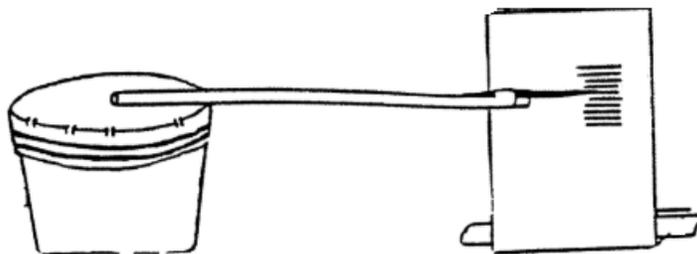
- How barometric pressure works
- How to make a barometer at home
- How to use a barometer to predict the weather
- How clouds are formed
- The relationship between barometric pressure and weather

Materials Used	Resources Used
Barometer <ul style="list-style-type: none"> • 1 jar • 1 balloon • Scissors • 1 toothpick • 1 plastic straw • Glue or tape • 1 index card Clouds in a Bottle <ul style="list-style-type: none"> • 1 clear 2 liter bottle • Water • 1 match 	<ul style="list-style-type: none"> • Making clouds in a bottle video: https://www.youtube.com/watch?v=G70y90BVes4 • National Weather Service current Surface Maps for pressure: https://www.weather.gov/oun/sfcmaps • How to read a surface map video: https://www.youtube.com/watch?v=GkE3F5AuWBQ • Gas Laws Activities that work for all ages: https://www.arborsci.com/blogs/cool/chemistry-gas-laws-smorgasborg

WHAT TO DO

Making a Barometer

1. Cut the nozzle off of the balloon, leaving only the large part of the balloon.
2. Stretch the balloon tightly over the open mouth of the jar.
3. Glue or tape the toothpick to one end of the straw and glue or tape the other end of the straw to the middle of the balloon on the jar.
4. Fold the index card so that it can stand up on its own, or attach it to something nearby when you set up the barometer in its final place. The final setup will look something like this:



5. When the jar and card are set up where you want them, place a mark where the toothpick is pointing and label it "5."

- On the card, make parallel markings 2 mm apart from the marking that you marked “5” and label each with decreasing numbers below and increasing numbers above. For example, the marking above 5 should be 6, and the marking below 5 should be 4. This will create a relative scale to measure whether the barometric pressure is increasing or decreasing.
- Because air can’t get in or out of the jar, when the pressure outside decreases, the balloon will bulge out and make the end of the straw point lower, and vice versa.

Making Clouds

- Fill a 2 liter bottle of water about $\frac{3}{4}$ full of water.
- Close the bottle and shake it up to get water droplets into the air inside.
- Open the bottle, light a match, and drop the lit match into the water in the bottle.
- Carefully put the cap back on without squeezing the air out of the bottle. Remember, we shook the bottle to get water droplets into that air, but if we let that air out we’ll lose that water vapor.
- Squeeze the bottle and release to make a cloud inside the bottle.
- What’s happening is that the tiny dirt particles in the air from the match are giving the water vapor something to coalesce around, just like in clouds in the sky. When we squeeze the bottle, we’re increasing the pressure and temperature and the water won’t condense, but when the pressure is released, the pressure and temperature go down and allow the water to condense around the particles in the air.

Tracking and Forecasting

- Using the barometer and the cloud activity, weather makes a lot more sense. Throughout the day or week, check the barometer and check to see what the sky looks like. How do the readings predict the weather?
- Tracking the pressure can be done with a table like the one below:

Date	Time	Pressure Reading	Weather Description
Ex. 3/30/20	11:15 am	3	Cloudy

- Using a newspaper or online weather map (see “Resources” section above), make predictions about what days will look like based on the map.

TIPS

- This data tracking fits with the other weather data tracking from this week’s activities.
- Younger kids may struggle with understanding air pressure because they may not be able to feel it very easily. You may need to show them how the barometer works by pushing on the balloon gently with your finger at first. Over time, and as the pressure changes outside, it will seem almost like magic, but linking it back to it being very slight pressure differences is important.
- Older kids can both be asked to explain how the barometer works, rather than being told.
- Older kids that have previously done the solar still activity in Temperature and Solar Stills have all of the knowledge and tools that they need to explain how the cloud activity works because the condensation principle is the same for both. Leaving out Step 6 in the “Making Clouds” section and having them try to explain it on their own is valuable critical thinking practice, even if they don’t get it right.
- The concepts used in making clouds is called commonly taught in Chemistry as the Ideal Gas Law, but there are a host of similar activities to cover the components of this law that can be found in the “Resources” section.