

**Topics** Air Pressure, Atmosphere, Weather

## Materials List

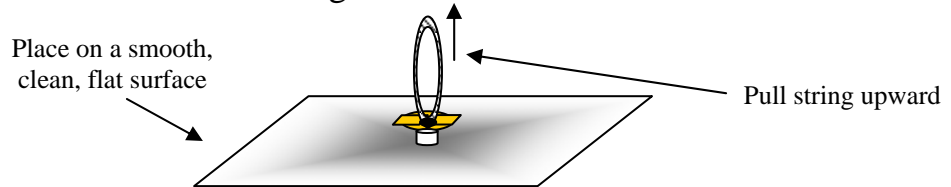
- ✓ Smooth, flexible, rubbery sheet, ~18 cm -30 cm (~7"-12") square
- ✓ Brad, 2.5 cm (1") long (the type used to fasten paper)
- ✓ "Brass" washer (made to use with the brad above)
- ✓ Mini pony bead, 6mm
- ✓ String or twine
- ✓ Needle nose or duck bill pliers

This activity can be used to teach:

- Properties of Gases (CA Science Standards: Grade 5, 1.g)
- Earth's Atmosphere (CA Science Standards: Grade 5, 4.e)
- Earth Systems (CA Science Standards: Grade 6, 4.e)

# Air – a Pressing Matter

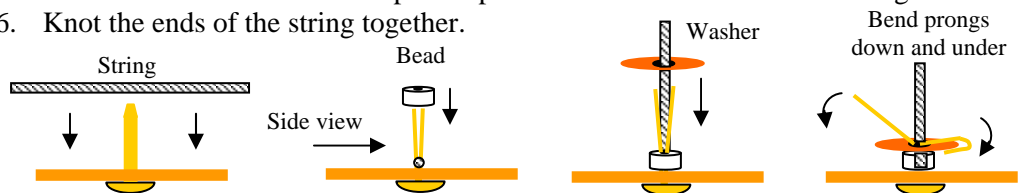
Have a "tug-of-war" with the air above!



Students are in for a surprise when they attempt to lift a mat that is held in place by only the air that is pressing down from above.

## Assembly

1. Insert a 2.5 cm (1") long paper fastening brad in the center of a square of smooth, flexible, rubbery material. The bottom of the material must be very clean.
2. Place the middle of a 15 cm (6") piece of strong string or twine in between the prongs of the brad.
3. Insert a mini pony bead over the prongs of the brad. Push the bead down firmly.
4. Insert the ends of the string and the brads' prongs into a washer made for brads.
5. Push the washer firmly down to the bead. Bend the ends of the brass prongs over and then under the washer. A pair of pliers is needed for the final bending.
6. Knot the ends of the string together.



## To Do and Notice

1. Place and press down the mat, string side up, on a smooth, clean, flat surface.
2. Grab the ends of the string, or put a finger in the loop of string, and pull upward firmly, but not **too** forcefully. (Too strong a pull will break the string, pull the washer/bead/brad connection apart, or cause the mat to lift off the surface due to an air leak.) What happens to the rubber mat?

## The Science Behind the Activity

Air pressure at sea level is equivalent to the force of ~1 kilogram per square cm (~14.7 pounds per square inch). The force on a 30 cm (12") square mat [area: 900 cm<sup>2</sup> (144 in<sup>2</sup>)] is equivalent to more than 900 kg (2,000+ lbs); more than 330 kg (700 lbs) for an 18 cm (7") square mat. Air is usually able to move under a lifted object. Here the close contact between the slick, rubbery material and the smooth surface makes for a near airtight seal. The weight of all the air from the mat surface to outer space is pressing the mat and surface together. The world record for weight lifting is ~300kg (~600 lbs.) so in this "tug of war" the air will win! A pull on the string will slightly lift the center of the mat due to a small pocket of air left around the head of the brad when the mat is placed on the surface. The pressure of the air above does not squash us because of the air inside our bodies. The push of the air inside balances the push of the air outside. Local air pressure can vary slightly, with areas of high and low pressure. These pressure differences can cause wind and weather changes.

**Web Resources** (Visit [www.raft.net/more](http://www.raft.net/more) for how-to videos and more ideas!)

- NASA web page - [http://kids.earth.nasa.gov/archive/air\\_pressure/](http://kids.earth.nasa.gov/archive/air_pressure/)
- Weather - [http://ww2010.atmos.uiuc.edu/\(Gh\)/guides/mtr/prs/home.rxml](http://ww2010.atmos.uiuc.edu/(Gh)/guides/mtr/prs/home.rxml)