

Demonstrating the Crushing Power of Atmospheric Pressure in Less than a Second

We have already carried out one Science at Home experiment which demonstrates the power of atmospheric pressure (The collapsing soda can and the power of atmospheric pressure). In that experiment we deduced that it is not actually pressure that causes a soda can to collapse but a difference in pressure; in that case we reduced the pressure inside the can so that the pressure outside it which hitherto had been in perfect balance with the pressure inside, collapsed the can.

In this experiment, we are going to further demonstrate the power of atmospheric pressure, in less than a second.

Atmospheric pressure is caused, literally by the weight of the air above you. To understand it better, use the analogy of water pressure, as you go deeper into water you have the equivalent weight of the water above your head pressing down on you. The deeper you go the more water above you, the greater the pressure. So it is with air pressure; the lower down you are the more air above you the greater the pressure. The higher you are, the lower the pressure. This explains why you can't make a decent cup of tea at the summit of Mount Everest; the pressure is so low because the summit is so high, that the water boils at 69 °C because at 8,848 m the pressure is 26,390 Pa compared to 101,325 Pa (at sea level), because boiling point is simply the temperature at which the vapour pressure of the boiling liquid equals the surrounding pressure.

MATERIALS

You will need:

- A Broadsheet newspaper;
- A standard wooden ruler;
- Safety glasses.

HEALTH & SAFETY

Safety glasses should be worn.

Ensure that no one is standing in the path of the flying ruler.

METHOD

Place the ruler on a table and let one end hang over the edge about 4 inches. For the sake of the exercise strike the end of the ruler that is hanging over the edge of the table with the edge of your palm, taking care that no-one is standing in the ruler's trajectory. As expected the ruler will fly off the table.

Now repeat the experiment only place a full double page of the broadsheet newspaper over the part of the ruler that rests on the table. Again strike the ruler with the blade of your palm. The ruler will not propel the paper off the table and will in fact either break or less likely, tear the paper.



DISCUSSION

The large surface area of the paper is what holds the ruler down. Pressure is defined as force/area, and the downward force of atmospheric pressure keeps the paper stuck to the table. The upward thrust of the ruler is concentrated in a small area of the paper and is therefore no match for the downward force of the atmosphere.

You could equate the force with a huge column of air resting on top of the newspaper, which is actually 250 miles tall. You can even calculate the weight pushing down on the paper, since atmospheric pressure is 14.696 pounds per square inch you can calculate the number of square inches on the paper and work out the total weight pushing down on the paper (My Daily Telegraph is 29 inches by 33 inches = 967 square inches which means there are 13,972 pounds pressing down on the paper).