

Balloons and air pressure

(Ukraine)

Background

The air around you has weight. As a result it causes pressure which acts in all directions. Atmospheric pressure is the force per unit area exerted on a surface by the air above it as gravity pulls it to Earth.

An atmosphere (atm) is a unit of measurement equal to the average air pressure at sea level at a temperature of 15° C. One atmosphere is 101.3 kPa.

The Earth's atmosphere is about 480 kilometres thick, but 90% of it is within 16 km of the surface. At sea level, air pressure is about 1 kg weight cm^{-2} or 10 N cm^{-2} or 100,000 N m^{-2}

You will need:

- ✓ Two balloons

Follow these steps:

1. Blow up a balloon just under half way, and tie a knot in it.
2. Take the knot and push it through to the other side of the balloon.
3. Holding the knot, twist the balloon and tie another balloon or string around it to hold the knot in place.
4. The balloon should now be inverted as in figure 1.
5. Push against the white board/wall/door and let go.

So what happened?

The balloon sticks to the whiteboard.

When you push on the balloon, flattening it against a smooth surface, the air underneath is forced out. This results in a partial vacuum under the balloon, i.e. near zero air pressure.

The air pressure underneath the balloon is now less than around the air pressure surrounding the balloon so the balloon sticks to the whiteboard. After some time some air leaks back in and the balloon falls off.

What next?

Attach a force sensor to the knot and **pull** to see how much force is required to remove it.

