

Bionic Plungers

Experience the force of the atmosphere

You will need...

- ✓ Two heavy rubber plungers (one of them with a small hole in it)

Background:

The atmosphere exerts a pressure on everything on Earth but why doesn't it crush us?

Follow these steps:

1. Push plungers together and pull them apart. This can be done relatively easily.
2. Now tell students that you have bionic strength and

can hold the plungers together while others try to separate them.

3. Let students push plungers together and then cover the hole with your finger. Students will not be able to pull plungers apart and will be amazed at your bionic strength.

So what happened?

The plungers were easy to separate when the hole was uncovered. This allowed air to enter. Covering the hole prevented air from entering and when the students tried to pull them apart, the volume increased between the plungers, thus decreasing the

pressure. The atmospheric air pressure held the two plungers together.

The size of the force depends on the pressure difference between the inside and the outside and on the area of the open end of the plunger. It is typically several hundred newtons or roughly the weight of a student.

What next?

1. Students could perform the collapsing can experiment and watch as the atmospheric pressure crushes a can.
2. They can also begin to provide explanations for everyday phenomena such as why aeroplane cabins need to be pressurised.
3. Estimate the volume change and hence the pressure change when the plungers are pulled. Measure the area and calculate the force. Verify the answer by measuring the force.
4. Learn more about Otto von Guericke's demonstration of the Magdeburg hemispheres in 1654.

