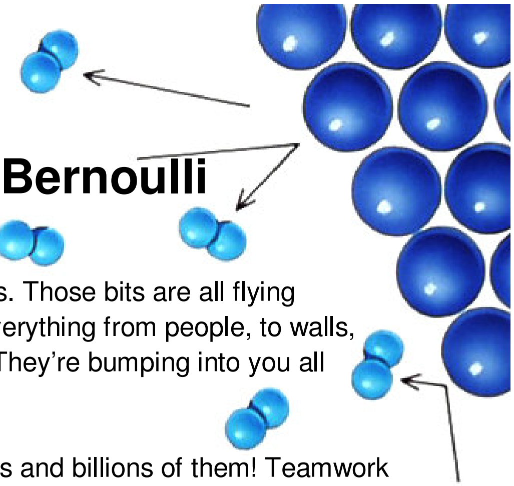
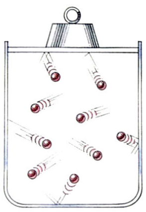
Falling Up!
Air Pressure and Bernoulli



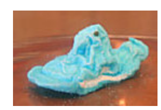
Today we played with air. Air is really just lots of tiny, tiny, tiny bits called molecules. Those bits are all flying around and bumping into things. They bounce around randomly, bouncing off of everything from people, to walls, to other little bits. They are even bouncing into you right now! Can you feel them? They're bumping into you all the time, so you probably don't notice it. They never stop!

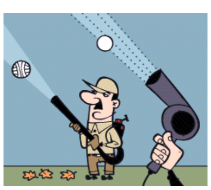


Can such tiny bits really bump very hard? They can if there are billions and billions of them! Teamwork helps, even for molecules. With so many of them bumping into you, they can add up to a pretty big push. How hard? Here's a way to think of it: Imagine shrinking down hundreds of heavy, 15 pound bowling balls down to the size of a quarter and then covering your body with those tiny heavy quarters. That's how hard the air is pressing on us, the walls, the floor, other air, everything! So why aren't we being crushed? Because our stuff (molecules) is pushing back, just like inside a balloon full of air.

A balloon holds around 50,000,000,000,000,000,000,000 molecules, all flying around bumping into the walls (and each other), making the balloon stretch out and stay big. But what about those bazillions of air molecules outside of the balloon? They're also bouncing into the outside and keeping the balloon small. Today we changed that. We used a vacuum pump to pull away the air from the *outside* of the balloon. Without the outside air to squeeze on the balloon, the balloon got bigger! Why? Imagine getting a really big hug for a really long time. What would you do when the hugger let go? As soon as you're not getting squeezed, you can spread out again. The balloon did the same thing, spreading out when the pressure from the outside went away.

Have you ever squeezed a marshmallow Peep? What happens when you stop? The same thing! The Peep spreads out! We removed the air from around marshmallows, which are made up of tiny air bubbles inside "mallow." The air inside the marshmallow pushed and pushed and, when the air outside was removed, made the marshmallow blow up! That wasn't the end, though, was it? When the air was allowed to surround the marshmallow again, the marshmallows shrunk to tiny raisin-like bits. It turns out those bubbles in the marshmallow popped and let the air out, so there was less stuff inside to push back against the outside air.





So what would happen if all those little bits stopped bouncing around randomly and started marching in one direction? Today we used a leaf blower to line up lots of air, but you can use your own breath to do the same thing. What happened when the bits of air all flew in one direction? Inside that air stream, the bits stopped bouncing around and pushing out. But that didn't stop the outside bits from pushing in, did it? Enough of those molecules outside of the air stream pushed in to keep a beach ball floating in mid-air!

Try it yourself: Blow between two balloons or even two soda cans and see if you can get the outside air to push the pieces of paper or cans together.

With all this talk about fast moving air and things floating, does this explain how airplanes fly? Good question. As it turns out, no one knows exactly. Don't worry, engineers figured out how to make planes fly without crashing (giving the plane "lift"), but there is a debate about what scientific phenomenon keeps planes in the air or if we even know enough to fully predict it. Can Bernoulli explain it? Can Newton? Who knows? Maybe you will be the person to finally solve the problem! (Check out the debate at http://www.grc.nasa.gov/WWW/K-12/airplane/bernnew.html)

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