

# Molecules in Motion



## What happens in a vacuum?

Try putting an object (a ball or another toy) in the plastic chamber. Find the matching object and keep that out for comparison.

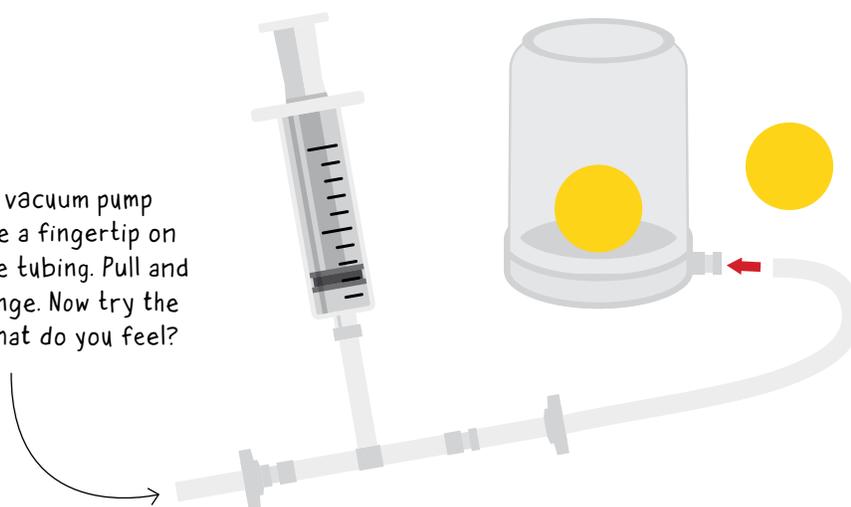
Secure the lid of the chamber and assemble the vacuum pump by attaching the tubing to the bottom of the chamber.



Remove some air from the chamber by pulling and pushing the syringe in and out. Do this several times to remove as much air as possible. What do you notice happening? How does the object in the chamber change as the air is removed?

Disconnect the tubing and syringe from the chamber to quickly let the air swoosh back in. What happens to the object?

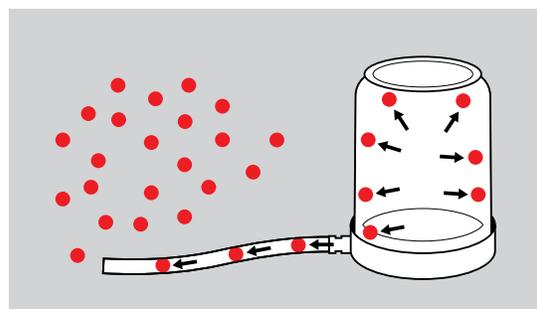
To feel the vacuum pump working, place a fingertip on one end of the tubing. Pull and push the syringe. Now try the other end. What do you feel?



**Let's keep experimenting!** Choose another object and place it into the chamber. Remove the air again to create a vacuum. Try to describe what you see, and why you think it happens. What differences do you notice between the objects that are in and out of the chamber?

# An important part of the process of chemistry is to experiment and try different things over and over.

We made a vacuum chamber! In this activity, we pulled nearly all of the air out of the container, resulting in lower pressure inside the chamber and higher pressure outside. The different objects placed inside the chamber all respond a bit differently to the changing air pressure. For example, the air trapped inside the squishy ball expands as air is removed from the jar because the ball material can easily stretch and grow, but the rigid ping pong ball couldn't change shape.



**As most of the air is pulled out of the chamber, any gas molecules left behind become more spread out.**

Air is a gas made up of atoms and molecules that are always moving around. Wave your hands in front of your face. Do you feel a breeze or draft? That feeling is due to the atoms and molecules moving around you. As the molecules inside a closed container move, they bump into the sides, creating pressure. You can change the air pressure by changing the amount of air inside a closed area.

## Chemists study how different materials behave and change, and how materials interact with each other.

By observing how objects and materials behave inside a vacuum, we can better understand how air molecules move and change in response to changing pressure. High above the Earth, at flying altitude, there is lower air pressure, so the air atoms and molecules are more spread out. There's even less air pressure in outer space. Air is pumped into the cabins of airplanes and spacecraft to make the pressure inside more similar to air pressure at Earth's surface. This makes it safer and more comfortable for passengers or astronauts.



**A NASA astronaut works in a pressurized suit outside one of the modules on the International Space Station.**

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*Imagine what it would be like to work and travel in outer space!*