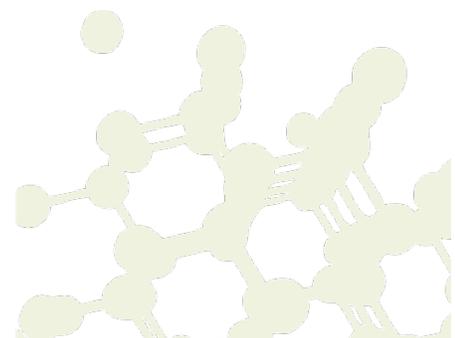




# Exploring Measurement— Molecules

*How small is a nanometer?*





# Exploring Measurement—Molecules

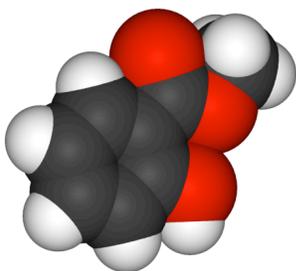
## Try this!

1. Smell the balloons. Each one has a flavored extract inside it. Can you identify all the different scents?
2. Why do you think you can smell the extracts through the balloon?

## What's going on?

Tiny scent molecules are leaking out of the balloons. They're too small to see, but you can smell them!

Your sense of smell works by identifying the shape of scent molecules. Molecules are made of particles called atoms that bond together. Everything in the world is made of atoms, including the balloon you're holding and the scented air inside it.



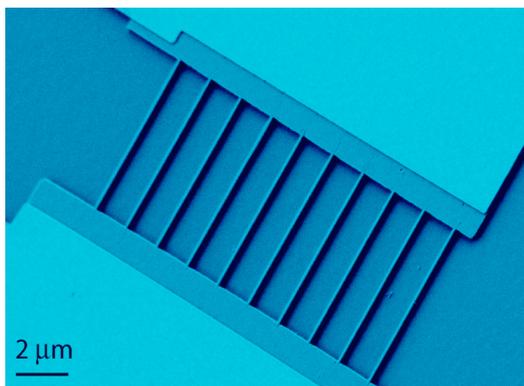
Molecular model of wintergreen oil

Scent molecules are so small that they can travel through the balloon membrane. In fact, they're so tiny that they're measured in nanometers! A nanometer is a billionth of a meter.

Air gradually leaks out of a tied balloon because the molecules inside the balloon move through the pores of the balloon's skin, in a process known as *diffusion*. Air always diffuses from areas of higher pressure to areas of lower pressure. An inflated balloon has greater air pressure than the air around it, so the air inside the balloon gradually escapes.

## How is this nano?

**A nanometer is a billionth of a meter.** That's very, very small—too small to see with just your eyes. We can use our sense of smell to explore the world on the nanoscale, because we can smell some things that are too small to see.



Biosensor with silicon nanowires

Nanoscale science focuses on the building blocks of our world, atoms and molecules. Scientists use special tools and equipment to detect and manipulate tiny, nanometer-sized particles.

In the field of nanotechnology, scientists and engineers make new materials and tiny devices. Researchers are creating tiny, nanometer-sized sensors that can detect very small concentrations of chemicals. Some of them work the way your nose does: by detecting the different shapes of molecules in the air.

