# Ideal Gasses vs Real Gasses

To understand the ideal gas approximation, it’s probably best to compare it to a real gas, such as the oxygen or nitrogen in the room around you. In a real gas, the gas is made up of particles with some small, but not exactly zero volume. In the ideal gas approximation, we assume that the molecules have exactly zero size. Similarly, in a real gas the molecules attract each other ever so slightly through van der Waals forces and the like. An ideal gas molecule, however, does not attract another ideal gas molecule, they don’t interact with each other at all. Also in our analysis of the ideal gas, we will typically ignore gravity. We’ll just turn it off and pretend it doesn’t have an effect.

These assumptions may seem to have no connection to reality. I mean, a gas of particles of zero size that don’t interact with each other and have no impact by gravity? Those seem like fairly, you know, unphysical conditions. However, if you think about an oxygen molecule, its volume is 10^-30 m^2, which is very small compared to the room you’re in, so the approximation that a gas has zero size for its particles is not actually that bad. Similarly, the force of the hydrogen bond is something on the neighborhood of 10-10 N, which again, is a very small force, so the idea that ideal gas molecules don’t attract each other at all is not a terrible approximation. In fact, carbon dioxide gas behaves like an ideal gas to 0.5% accuracy at everyday pressures and temperatures. So, we can use the ideal gas to get a very good idea of how real gases are behaving under a variety of typical conditions.

Let’s explore the consequences of this ideal gas approximation. So first we’ve turned off gravity, what effect does that have? Well, without gravity the particles have no gravitational potential energy, only kinetic energies are possible. There’s no g for the mgh. Furthermore, without gravity, particles travel in a straight line until they run into something. They do not follow the parabolic arcs that we’ve been studying in our third unit. Now let’s explore the consequences of the fact that ideal gas particles have zero size and zero intermolecular force. Well, two particles of zero size cannot collide. Think about that one for a minute, but you’ll see it’s true. Since they can’t collide with each other, the particles only hit the walls. The combination of these two approximations means that ideal gas particles travel in straight lines until they hit a wall.