

Matter: Moving Particles

The states of matter are the physical forms of a substance. The states of matter depend on the motion of particles.

Matter is made up of very tiny particles called *atoms* and *molecules*. Atoms and molecules are in constant motion and are always bumping into each other. The motion of particles is different for each state of matter. The way that the particles interact with each other also helps determine the state of the matter.



Particles of a solid have a strong attraction between them. The particles are closely locked in position and can only vibrate.



Particles of a liquid are more loosely connected than those of a solid and can collide with and move past one another.



Particles of a gas move fast enough so that they overcome the attractions between them. The particles move independently and collide frequently.

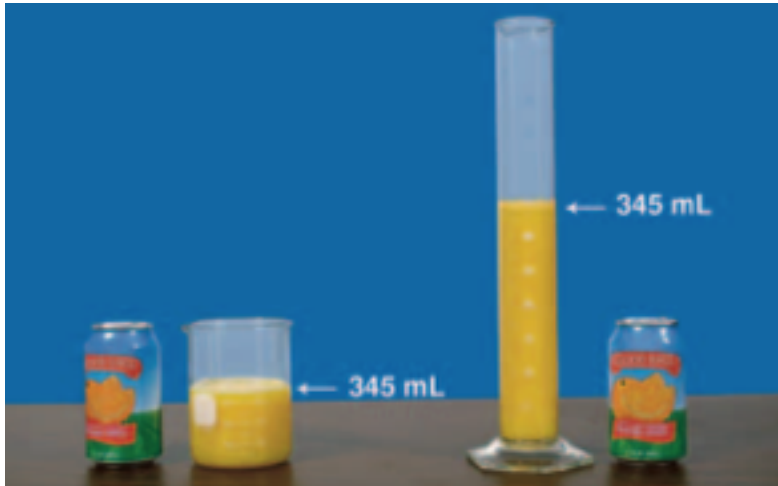
Solids

A solid is the state of matter that has a definite shape and volume.

The particles of a substance in a solid state are very close together. They have a strong attraction between them. The particles in a solid move, but they do not move fast enough to overcome the attraction between them. Therefore, each particle is closely locked in position and can only vibrate in place.

Liquids

Liquid is the state of matter that has a definite volume but takes the shape of its container. The particles in liquids move fast enough to overcome some of the attractions between them. The particles collide with and slide past each other. But the particles remain close together.



Gases

Would you believe that one tank of helium can fill several hundred balloons? How is this possible? After all, the tank is only as big as about five filled balloons.

Gas is a state of matter that has no definite volume or shape. The particles of a gas have little attraction between them. The particles move about freely and collide randomly with each other.

Because gas particles move about freely, the amount of empty space between them can change.



Figure 3 Many balloons can be filled from one tank of helium because the particles of helium gas in a balloon are far apart.

Plasmas

The sun and other stars are made of the most common state of matter in the universe, called plasma. Plasma is the state of matter that does not have a definite shape or volume and whose particles have broken apart. More than 99% of the matter in the universe is plasma.



Plasmas have some properties that are quite different from the properties of gases. Plasmas conduct electric current, but gases do not. Electric and magnetic fields affect plasmas but do not affect gases. In fact, strong magnetic fields are sometimes used to contain very hot plasmas that would destroy a solid container.

Here on Earth, natural plasmas are found in lightning and fire. Plasma sometimes forms during storms on Earth by the electrical energy in lightning