This lesson explores the kinetic molecular theory and how it pertains to the properties of solids and liquids. You'll learn the properties of solids and liquids, discover the types of intermolecular attractions that occur between them and gain an understanding of how phase changes happen.

Kinetic Molecular Theory

Take a glass of water. Drop a few drops of red food coloring in it. What happens? The red food coloring drops should make their way down the glass of water slowly, spread out and finally tint all of the water a reddish color. Why does this happen? It happens because both substances are made out of molecules that are constantly moving. These molecules have energy; one of the fundamental principles of the kinetic molecular theory.

The **Kinetic Molecular Theory (KMT)** is a model used to explain the behavior of matter. It is based on a series of postulates.

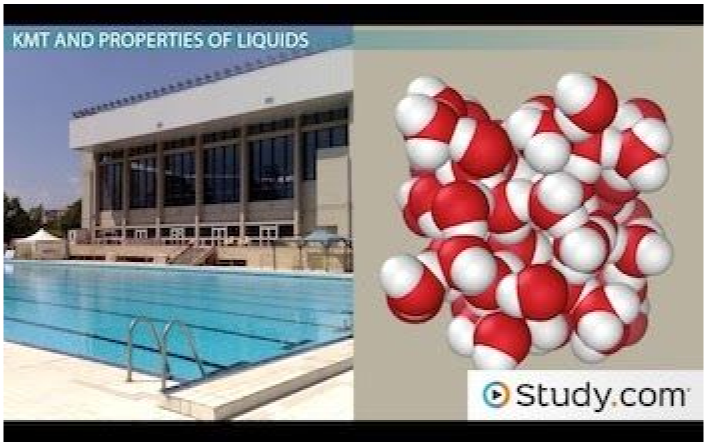
Some of the postulates of KMT are as follows:

- Matter is made of particles that are constantly in motion. This energy in motion is called **kinetic energy**.
- The amount of kinetic energy in a substance is related to its temperature.
- There is space between particles. The amount of space in between particles is related to the substance's state of matter.
- Phase changes happen when the temperature of the substance changes sufficiently.
- There are attractive forces in between particles called **intermolecular forces**. The strength of these forces increase as particles get closer together.

In this lesson, we will focus on how KMT can be used to explain the properties of liquids and solids.

KMT and Properties of Liquid

Check out these two pictures of liquid water:



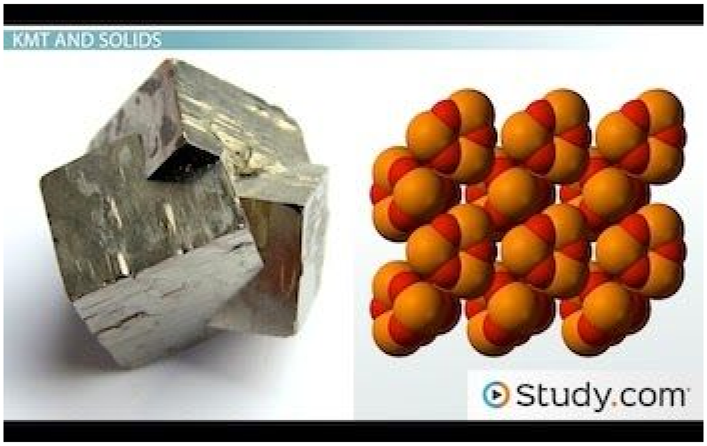
One is a photo of water in a swimming pool; the other is of liquid water on the molecular level. What properties of liquids are evident in these two pictures?

One of the most notable **properties of liquids** is that they are fluid and they can flow. Liquids have definite volume, but not a definite shape. Liquids are said to have low compressibility; in other words, it's hard to pack liquid particles closer together. Compared to gases, there is relatively little space between particles. Compared to solids, however, liquids have some space between particles. This, in tandem with the fact that liquid particles also have relatively more energy than solid particles, is what allows liquids to flow. On the molecular level, these two factors give liquids the look of being disorganized.

The types of intermolecular forces in a liquid depend on the chemical make up of the liquid itself. Strength of intermolecular force is related to the type of intermolecular force, but it is also affected by the amount of kinetic energy in the substance. The more kinetic energy, the weaker the intermolecular forces. Liquids have more kinetic energy than solids, so the intermolecular forces between liquid particles tend to be weaker. We will discuss types of intermolecular forces later.

KMT and Solids

Now, let's check out some solids:



One of these images is of pyrite crystals in their naturally occurring cubic form; the other is the structure of phosphorus trioxide on the molecular scale. What **properties of solids** do you notice?

Solid substances have definite shapes and volumes. Solid particles do move, but not very far! Solid particles have relatively little kinetic energy and vibrate in place. Because of this, they can't flow like liquids. Most solids are arranged in a tightly packed crystalline structure. The crystalline structure is an orderly, repeating arrangement of particles called a crystal lattice. The shape of the crystal shows the arrangement of the particles in the solid.

Some solids aren't crystalline-shaped. The ones that aren't are called amorphous solids. **Amorphous solids** don't have orderly internal structures. Examples of amorphous solids include rubber, plastic and glass. Wax is also an amorphous solid. It can be molded into any shape and remolded anytime it is warmed up a bit.