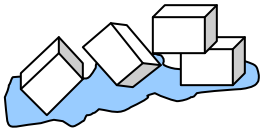
Name _____

States of Matter and the Kinetic Theory

In this lesson you will find out if what you remember about matter is correct—or "all wet."



Can you describe what is happening as ice melts in *scientific* terms?_____

_____

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_____

Thinking about Matter

Complete the following table.

States of Matter

	Solid	Liquid	Gas
General Properties			
Description of Particles			
More Everyday Examples			

The Kinetic Theory of Matter

Why can you put your hand through liquids or gases but not through solids? Yes, solids are usually hard—but why? What happens to water (a liquid) when it becomes solid?

And what about gases? You can boil water, and turn it into water vapor, the gaseous form of water. It floats off and mixes into the air, making the room you are in more humid. Or you can let the helium out of a balloon and it mixes with the air in the room. That air is a mixture of many other gases (mostly nitrogen, but also oxygen, carbon dioxide, water vapor, and others). Each of these gases is invisible. Why? What is it about a gas that makes it invisible? The answer to these all of these questions has to do with atoms and molecules.

Every substance is made up of atoms and molecules. Water is made up of water molecules, whether it is in the form of ice, liquid water, or water vapor. The molecules that make up water are constantly moving – faster in the liquid state than in the solid state, and even faster in the gas state.

Molecules of liquids have more energy than those of solids, and gases have the highest energy of the three states. While all matter is mostly empty space, the particles in a solid are close enough that they form definite structures. They move—but more slowly than liquids or gases. In water, for example, the negative ends of one molecule are attracted to the positive ends of other molecules. This attraction holds each molecule in a set position, and the entire substance maintains a definite shape and volume.

In the liquid state, the molecules have more energy and move faster. They can break out of their rigid array and move past each other, bouncing off each other when they collide. They stay close together, though, because they are not moving fast enough to break completely free from the force of attraction that holds them together. They can change shape to adapt to their container. But they can’t be compressed into a smaller volume.

In the gas state, the molecules move so fast that the force of attraction among them cannot hold them together at all. Molecules of a gas move randomly and change direction only when they bump into other molecules or the sides of the container. They spread out to fill their container. If their “container” is the atmosphere, they spread out everywhere around the Earth, mixing with all the different gases that make up the atmosphere. We say that gases do not have a definite volume or definite shape.

There is a fourth state of matter, the plasma state. Plasma exists only at extremely high temperatures. Plasma consists of electrically charged particles and, like a gas, has no definite shape or volume. Stars are made of plasma.

Temperature is very important to the motion of molecules. An increase in temperature means an increase in the average energy of the molecules. The warmer the temperature, the faster the molecules move. A decrease in temperature means a decrease in the average energy of the molecules. The colder the temperature, the slower the molecules move. This is why the temperature of a substance determines its state.

Thinking It Through

1. How can you explain the differences between solids, liquids, and gases?

2. Why do solids have a definite shape, while liquids flow downhill and gases move throughout their containers?

3. Why can you put your hand through a liquid, but not a solid?

4. Why do gases spread throughout a room or through the air, but liquids or solids stay together?

5. Why can you see liquids and solids, but not most gases?