

Name _____

Date _____

The States of Matter

Scientists call any material in the universe “matter.” However, if you look around, you will see that the world is made up of millions of different kinds of matter. To help organize the nonliving things in the universe, scientists classify them into one of five states of matter. The states of matter are solid, liquid, gas, plasma, and Bose-Einstein. Today you will learn about the three states that appear most often: solid, gas, and liquid.

Solids

When matter is in a solid state, it holds its shape. The molecules of the matter are very close together, and they barely move. The atoms that make up the molecules of a solid *are* in motion, because all atoms are moving all the time. Even though the tiny atom particles are in motion, the molecules are not free to go anywhere they want. The solid stays in one position. You can hold a solid in your hand.

Many solids do not have much, if any, flexibility. That means they can't be easily bent or molded into a new shape. For example, a rock can not change its shape unless it breaks. Some solids, like clay, can be molded and changed. But some kind of force must be applied to change the shape.

Gases

When matter is a gas, it's usually difficult to see. Gas is sometimes called “vapor.” In a gas, the molecules are very far apart. In fact, gas will fill a container of any shape by spreading out as much as possible. Gas can take on any shape, because the molecules are constantly moving around. Because the molecules of gas are in constant motion and trying to fill the space, you cannot hold gas in your hand.

Gasses are all around us. The atmosphere of the earth is made up of several gases. The air we breathe is actually a gas, and gases fill every room of every building. To see how gas takes up space, try inflating a balloon. The gas will take on the shape of the balloon, no matter how the balloon is shaped.

Liquids

Liquid is considered to be a transition state. That means a liquid is “in between” the solid and gas states of matter. The molecules in a liquid are not as close together as those in a solid, but they aren't as spread out as the molecules in a gas. Liquid molecules tend to stick together, so liquids flow when moved. Although liquids are held together by force, they are much easier to divide than solids.

Like a gas, liquids take on the shape of their container. Unlike a gas, they do not expand to completely fill the space. You can hold liquid in your hand, but it will quickly find its way through the cracks and leak out. Liquid will always flow down because of gravity. Gravity is also the reason liquid matter has a flat surface. Liquid, like a gas, cannot hold its shape unless contained.

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The States of Matter (Cont'd)

Shifting States

Matter can transition from one state to another by going through a physical change. A physical change will occur if energy is added or taken away. Energy can be added by increasing the temperature or pressure. Energy can be taken away by decreasing temperature or pressure. Let's use water to see how this works.

Imagine an ice cube sitting in glass bowl on your counter. The cube is actually water in a solid state. The ice cube is a solid, because its molecules are barely moving, and it is holding its shape. Now, imagine that you move the bowl outside into the sun. The heat of the sun increases the temperature of the ice cube. This added energy causes the cube to melt. Eventually, the cube completely melts and becomes a liquid.

Now in a liquid state, the water takes on the shape of bowl. The molecules stick together, but are more loosely connected than before. The surface of the water in the bowl is flat. If we leave the bowl in the sun, the temperature of the water will continue to increase. As the water heats up, it turns into water vapor. Now the liquid water has transitioned into a gas. The process of liquid turning into a gas is called **evaporation**.

By increasing the temperature, we have been able to shift matter through all three states. We can also go backwards. Water vapor can condense under pressure and become liquid water. Then the water can be frozen into an ice cube again.

Summing Up

Much of the matter in the world changes state because of natural shifts in temperature and pressure. However, scientists have learned how to apply pressure and temperature to different kinds of matter to get the results they need. For example, CO₂ gas is compressed into a liquid so it can be transported on trucks. And liquid can be converted into gas to power an engine. Even cooks use temperature to melt solid foods into liquids. The next time you encounter a state of matter, consider how it was made. And ask yourself what kind of energy would be needed to change its state.

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The States of Matter Questions

Use words from the word bank to fill in the blanks.

Solid	Liquid	Gas	Evaporation	Energy
Pressure	Molecules	Physical change	Matter	Vapor

1. Solid, liquid, and gas are the three most common states of _____.
2. The process of turning a liquid into a gas is called _____.
3. By adding or removing _____, we can change the state of matter.
4. We can determine the state of matter by observing how closely its _____ are connected.
5. _____ is another name for gas.
6. In a _____ state, the molecules are loosely connected, and the matter takes on the shape of the container.
7. In a _____ state, molecules are stuck together, and the matter cannot easily change shape.
8. The molecules of matter in a _____ state spread as far apart as possible and fill the space of the container.
9. In order for matter to change state, it must go through a _____.
10. Physical changes to matter can occur if there is an increase or decrease in temperature or _____.

Read each sentence. If the statement is true, write a T in the blank. If it is false, write an F.

- ___ 1. Solids can expand to fill the space in a container.
- ___ 2. Liquids are held together by force, and can not be divided.
- ___ 3. Gases have molecules that are in constant motion.
- ___ 4. After evaporation, the matter is a gas.
- ___ 5. All matter can be changed by adding or removing energy.
- ___ 6. Temperature and pressure changes can cause matter to shift state.
- ___ 7. When a solid melts, it becomes a vapor.
- ___ 8. Gas has a flat surface because of gravity.
- ___ 9. Scientists can cause physical changes in matter.
- ___ 10. A gas can be compressed into a liquid.

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The States of Matter Answers

Fill in the blank

1. matter
2. evaporation
3. energy
4. molecules
5. vapor
6. liquid
7. solid
8. gas
9. physical change
10. pressure

True or False

1. F
2. F
3. T
4. T
5. T
6. T
7. F
8. F
9. T
10. T