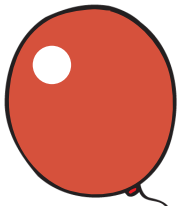
Introduction

Look around you. Everything you see is **matter**. What is *matter*? Matter is anything that has **mass** and **volume** (takes up space). *Mass* is the amount of matter in an object. Remember that **weight** is the force of **gravity** pulling on the object. An object's weight depends on its mass and whether *gravity* is pulling on it. Earth does not pull on stars that are far away. Because of this, we cannot really talk about their *weight*. They do have mass, though, and they are matter. All matter takes up space. That means it has *volume*. So we have learned that all matter has mass and volume.

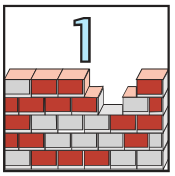


A full balloon takes up more space than an empty balloon.

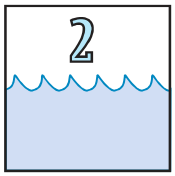
Even air is matter. It has mass and it takes up space. An empty balloon has less mass than a balloon that has been filled with air. The difference between the two is the mass of the air. The full balloon takes up more space than the empty balloon. You can see that air takes up space.

Not all matter is the same. Look at the different kinds of matter in the room. Books, tables, the air you are breathing, and the water in the sink are all different **forms** or **states** of matter. Scientists call the *form* of matter its **phase**. *Phases* are one way to classify matter. There are four phases of matter. **Gases**, **liquids**, and **solids** are all phases of matter commonly found on Earth. The fourth phase of matter is **plasma**. It is a form of matter found in stars, such as the sun. Although *plasma* is common in the universe, we have little chance to observe plasma. Matter in the plasma phase is extremely high in energy and therefore dangerous to living things. On Earth, plasmas usually do not occur naturally except in parts of flames and in lightning bolts.

Phases of Matter Commonly Found on Earth



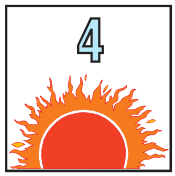
solids



liquids

gases

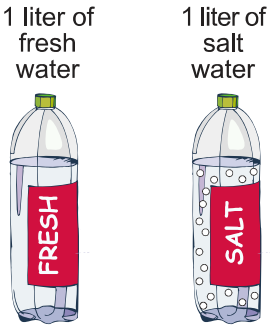
Phase of Matter Commonly Found in the Universe



plasmas

Physical Properties

In what ways can you describe matter? Suppose you have a few solids in front of you. How could you describe them? You probably will begin by describing their color, shape, size, or degree of hardness. The characteristics that you observe without changing the matter are called **physical properties**. It is easy to see color, shape, and size, and to feel hardness. Another *physical property* is **density**. *Density* is the amount of mass of a certain material in a certain volume.

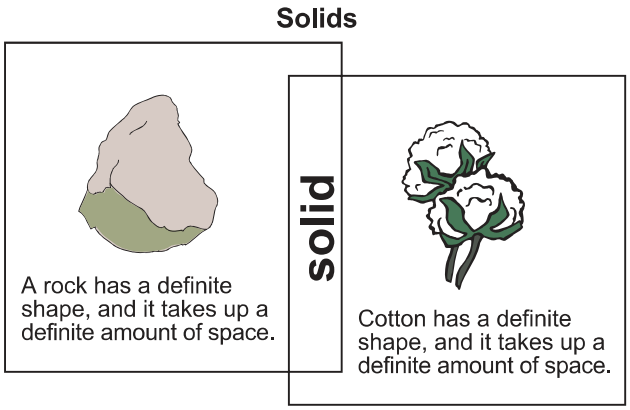


The container filled with salt water has more mass than the one with fresh water.

For example, two liter containers are filled with liquids. One container is filled with fresh water. The other container is filled with salt water. The container filled with salt water has more mass than the one with fresh water. That's because salt water has more density than fresh water. The containers have the same volume, but different masses. The difference is in the density of the liquids.

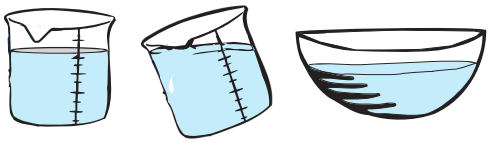
Density is a physical property of matter. Density helps determine the use of many different materials. For example, the comparison of the density of wood and the density of Styrofoam can determine *how* each material is used, and for *what purpose*.

All matter has the general physical properties of mass, weight, volume, and density. However, phase, or state of matter, is also an important physical property.



A *solid* must have a definite shape and take up a definite amount of space. Look at a rock. It has a definite shape, and it takes up a definite amount of space. Therefore, it is a solid. Rocks are hard, but cotton is soft. Is cotton a solid? Think. Cotton has a definite shape. It takes up a definite amount of space, so cotton is also a solid.

Can you change the shape of a rock or the shape of cotton? Just because the shape of something can change, its shape is not indefinite. If something or someone did not change them, then their shapes would remain the same. This is what is meant by a definite shape. A solid is able to keep its definite shape because the tiny particles that make up a solid are packed very close together. The particles are only able to vibrate since they cannot move far out of their places.

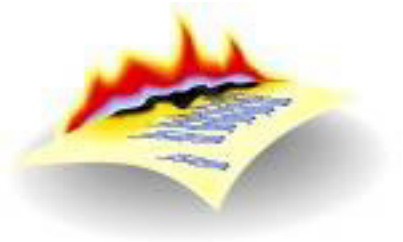


A cup of water takes up space in a beaker. If you tilt the beaker or put the water in a bowl, the water changes shape but it is still the same amount of water.

Matter can be a *liquid*. Pour one liter of water into a liter beaker. It takes up space. Tilt the beaker. The water changes shape. Pour the water into a bowl. It still is a liter of water, but it has a different shape. Liquids have a definite volume but not a definite shape. The particles in a liquid are not held as tightly together as they are in a solid. So the particles in a liquid are free to move.

Some matter is in the form of *gas*. Blow up a balloon. The air takes up space or volume. The air inside the balloon has mass. It does not have its own shape. Gases take on the shape of whatever they are in at the moment. They also fill whatever they are in because the particles of gas tend to spread far out from one another. It is possible for a beaker of water to be half empty. However, a balloon filled with air cannot be half empty. Even when a balloon gets smaller, the new shape is always completely full of gas.

Chemical Properties



Paper burns resulting in a chemical property change.

We learned that **chemistry** investigates how matter changes. **Chemical properties** of matter depend on how one substance **reacts** with other substances. Paper burns. That is because it reacts with oxygen in the air. Iron rusts when it reacts with oxygen. Rusting is a result of a *chemical property* change in which a different substance is produced and the matter changes. Some materials produce gases or metals when they react with other materials. **Chemists** study these changes. Sometimes they can improve products by using the chemical properties of matter.

Summary

In this unit, we learned how to recognize matter in its different phases. We found out that matter has mass and volume. We are beginning to recognize some of the physical and chemical differences of matter.