

## Reflect

Every day, we interact with many different kinds of matter. We look at it, feel it, taste it, and even breathe it. Sometimes different types of matter are combined. For example, a salad might have several types of matter, or **ingredients**, such as lettuce, tomatoes, and onions. Or, a sample of soil might include sand, leaves, and pebbles.

In these examples, you can see each ingredient individually. It's pretty easy to pick out each part of a salad mixture. With a little more effort, you could separate the parts of a soil mixture. But, think about lemonade, a drink that contains water, lemon juice, and sugar. You cannot see each ingredient, so is lemonade really a mixture?

### Are all mixtures the same?

To scientists, a mixture is a combination of two or more substances in which no new kinds of matter are formed. Making a mixture results in **physical changes** only. In the example of a salad, all of the ingredients are combined, but they do not form any new substances. Similarly, sand, leaves, and pebbles are combined to make a soil mixture, but the combination does not result in any new substances. The same is true even about lemonade. Even though you are not able to see each ingredient once the mixture has been made, new substances are not formed.

Mixtures are combinations of solids, liquids, or gases. Sand and clay is an example of a mixture of solids. Salt water is a mixture of solids and a liquid. The air around us is a mixture of gases. Although it contains some dust particles, air is mostly made of gases called nitrogen, oxygen, and water vapor.

**ingredients:**  
the separate parts of a mixture



What properties could you use to separate the ingredients in these mixtures?

**physical change:** a change to matter in which no new kinds of matter are formed

**physical properties:** characteristics of matter that can be observed and measured without changing the matter

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In some mixtures, the ingredients keep all their **physical properties**, such as shape, size, and color. When this happens, the ingredients are easy to separate. Think about a bowl of snack mix made with pretzels and raisins. You can use properties like size and shape to separate the pretzels from the mixture. However, even mixtures such as saltwater or lemonade may be separated by physical means. You will learn how to separate mixtures later in this companion.

## Try Now

Take a little time to investigate some mixtures.

1. For this activity, you will need the following supplies:
  - Two clear plastic cups
  - Six marbles
  - Water
  - Steel paper clips
  - Small, dry noodles such as elbow macaroni
  - A magnet
2. In one of the cups, make a mixture of water and marbles. Then separate the mixture.
3. In the other cup, make a mixture of marbles, dry noodles, and steel paper clips. Then separate this mixture.
4. What physical properties did you use to help you separate each mixture? Could you have used other properties?

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### Everyday life: Blood is a mixture, too!

Blood is a mixture of different **cells** and a liquid substance called plasma. There are three types of cells in blood: platelets, white blood cells, and red blood cells. Each cell has a specific job to help keep the body healthy. Sometimes people do not have enough of one type of blood cell and they become sick. Luckily, healthy people around the world donate their blood to help other people who may need it. The donated blood can be separated using a special spinning process. Then the separate parts of the blood can be given to people who need each part.

**cells:** the smallest living parts of an organism



Blood is a mixture of red and white blood cells, platelets, and plasma.

## Reflect

### What makes a solution a unique type of mixture?

In some mixtures, the physical properties of the ingredients change when they are mixed together. Think again about lemonade. When you add lemon juice to water, the water changes color. Then, when you add sugar to the mixture and stir, the sugar **dissolves** and is no longer solid white. Lemonade is an example of a **solution**: a mixture of one or more substances dissolved evenly into another substance.

A solution has physical properties that are a combination of properties from its ingredients. For example lemonade has a yellow color from the lemon juice and a sweet taste from the sugar.

**dissolve:** to spread out evenly in a liquid

The ingredients in a solution cannot be separated by hand because of changes in the ingredients' physical properties.

**evaporation:** the process by which a liquid changes into a gas

But, **evaporation** can be used to separate some solutions. For example, if you heat a solution for a while, the water will evaporate. The salt will be left behind.



Lemonade is a special type of mixture called a solution.

## Look Out!

When a substance dissolves, it does not disappear. Its physical properties simply change. For example, if you dissolve salt in water to make a solution of saltwater, the salt does not disappear. The salt particles mix evenly with the water particles, forming a clear, liquid solution.

## What Do You Think?

Take a look at the photographs below. Can you identify which mixtures are solutions? Can you think of any other examples of solutions?



## Try Now

Spend some time investigating the properties of solutions.

1. For this activity, you will need the following supplies:
  - Four plastic cups
  - Water
  - Sand
  - Sugar
  - Salt
  - Food coloring (any color)
  - A spoon
2. Fill one of the cups about halfway with water. Add a few spoonfuls of sand and stir for at least one minute. Describe any changes in the sand and water.
3. Repeat Step 2 with water and sugar, then with water and salt, and finally with water and food coloring. Be careful when you use the food coloring—it can stain your clothing. You need to use only a few drops.
4. Which mixtures formed solutions? How do you know?

## Reflect

### Getting Technical: Drinking Ocean Water

We all need water to survive. In some parts of the world, people have a hard time finding fresh water to drink. Earth has plenty of saltwater in its oceans, but people cannot drink water that contains a lot of salt—it would make them very sick. To help provide people with safe drinking water, scientists developed a process called *desalinization*, which removes the salt from ocean water. In this process, ocean water is heated in a large container until it boils and evaporates. A smaller container collects the evaporated water, cools it, and turns it back into a liquid. Salt cannot evaporate, so it is left behind in the original container. Unfortunately, desalinization uses a lot of energy. In many parts of the world, the process of removing salt from water is too expensive for people to use reliably.



## What Do You Think?

### What do you know?

A mixture is a combination of two or more substances in which no new kinds of matter are formed. A solution is a mixture of one or more substances dissolved evenly into another substance. The chart below lists ingredients that were combined to make a mixture. Some of the physical properties of the mixtures are also listed. Study the chart. Then decide if the mixture is a solution. Write yes or no in the blank spaces of the chart, and explain your answers.

Ingredients in Mixture	Observations after Combining Ingredients	Is it a solution? Explain your answer.
Water, gravel	Water is clear; gravel is the same shape and color.	
Water, red powdered drink mix	Water is red; powdered drink mix is not clearly seen.	
Water, cooking oil	Water is clear, but settled on the bottom of the container; oil is the same color, but formed a layer on top of the water.	
Water, rice	Water is clear; rice is the same color and shape, but settled on the bottom of the container.	

## Mixtures Close to Home

To help your child learn more about mixtures and solutions, spend some time at home finding examples of different mixtures that are used regularly. Discuss whether or not the mixtures are solutions. A few common examples of mixtures used at home include milk (a mixture of cream, buttermilk, and skim milk), carbonated water (a mixture of carbon dioxide gas and water), and soap (a mixture of salts and air bubbles). Even brass is a mixture—it is composed of one metal (zinc) dissolved into another metal (copper). After they are combined, the metals harden.

If time allows, have your child explore the separation of a solution by making and then evaporating saltwater. Fill a cup with water and dissolve as much salt as possible in the water. Continue stirring and adding salt until no more salt will dissolve. (Heating the water in a pot on the stove will help speed up the process of dissolving the salt.) Hang one end of a string in the saltwater and tie the other end to a pencil. Set the pencil across the top of the cup. Place the cup on a warm sunny windowsill, and observe it for several days. Use a magnifying lens to observe salt crystals as they form on the string and along the sides of the cup.

Here are some questions to discuss with your child:

- Why is saltwater an example of a solution?
- What happened to the physical properties of the ingredients in saltwater when you mixed them together?
- What are the properties of the saltwater solution?
- Why did salt form on the string and on the sides of the cup?