**SC.5.P.8.2** Investigate and identify materials that will dissolve in water and those that will not and identify the conditions that will speed up or slow down the dissolving process. **SC.5.P.8.3** Demonstrate and explain that mixtures of solids can be separated based on observable properties of their parts such as particle size, shape, color, and magnetic attraction.

LESSON 4

ESSENTIAL **QUESTION**

# What Are Mixtures and Solutions?

## Engage Your Brain

As you read the lesson, look for the answer to the following question and record it here.

**How are a smoothie and a salad alike? How are they different?**

## ACTIVE **READING**

### Lesson Vocabulary

List each term. As you learn about each one, make notes in the Interactive Glossary.

### Problem and Solution

Ideas in this lesson may be connected by a problem-solution relationship. Active readers mark a problem with a *P* to help them stay focused on the way information is organized. When multiple solutions are described, they mark each solution with an *S*.

# Matter Mix-Up

A box of colored pencils. A basket of footballs, tennis balls, and hockey pucks. A toy box full of toys. All these things are mixtures. But what is a mixture?

**ACTIVE READING** As you read the next page, draw two lines under the conclusion. Draw one line under each fact that leads to the conclusion.

This fruit salad is a mixture of different pieces of fruit.

Look at the mixtures on these pages. They have a few things in common. First, two or more substances or objects were combined. The fruit salad has several types of fruit. The laundry pile has several types of clothing. Second, each type of matter in a mixture keeps its own identity. The peach in the fruit salad is the same type of matter as it was before it was mixed into the fruit salad. The jeans in the laundry pile are still jeans.

By now, you've probably figured out that a **mixture** is a combination of two or more substances that keep their identities. The parts of a mixture don't undergo a chemical change. Making a mixture is a physical change.

**A carbonated beverage is a mixture of water, gases, and other ingredients.**

▶ **These clothes are all jumbled together. How do you know this pile of laundry is a mixture?**

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_____

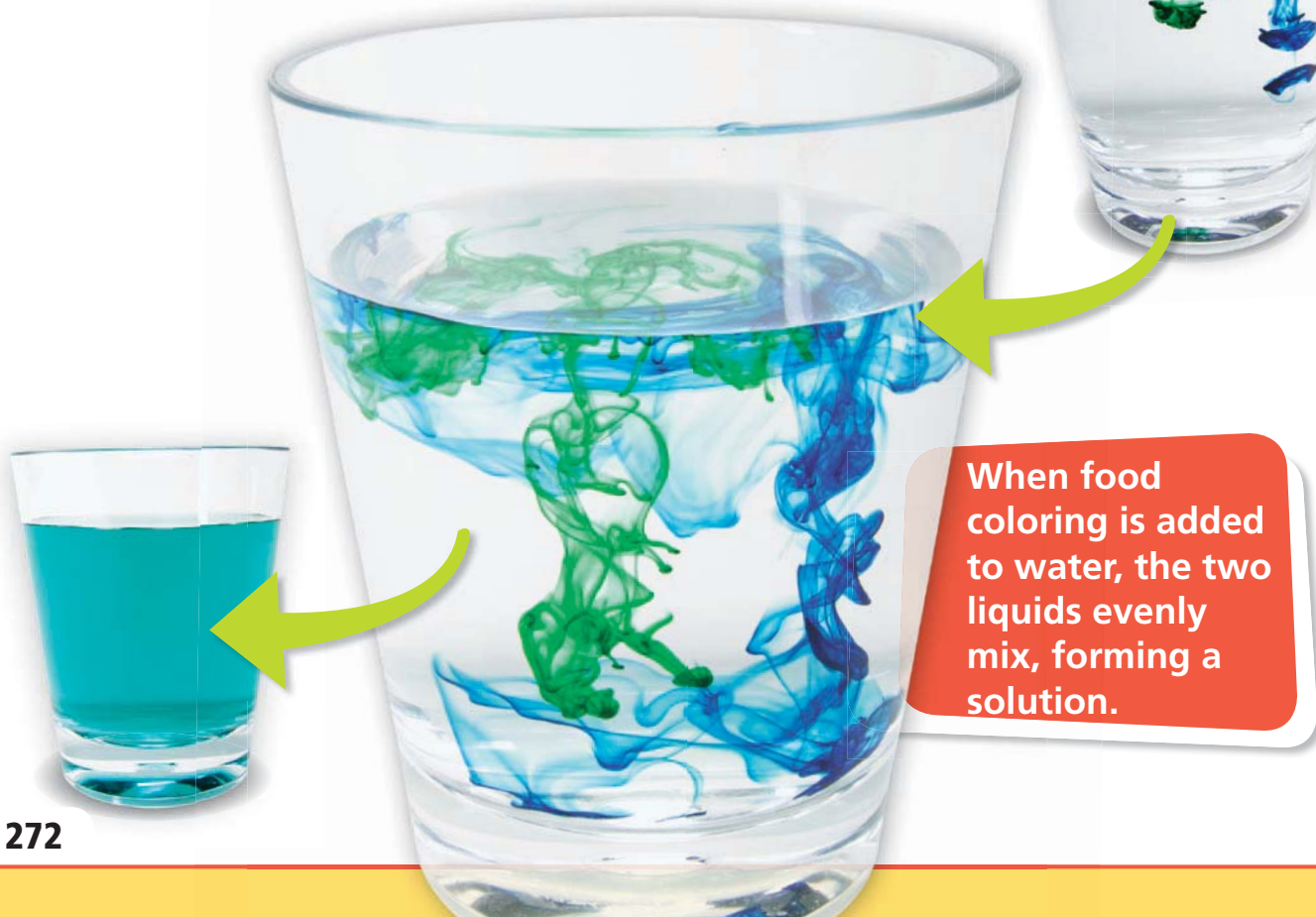
_____

# Find a Solution!

In some mixtures, it's easy to see the individual pieces that are mixed together. In other mixtures, small parts are very evenly mixed. What are these special mixtures?

**ACTIVE READING** As you read these two pages, underline lesson vocabulary words each time they are used.

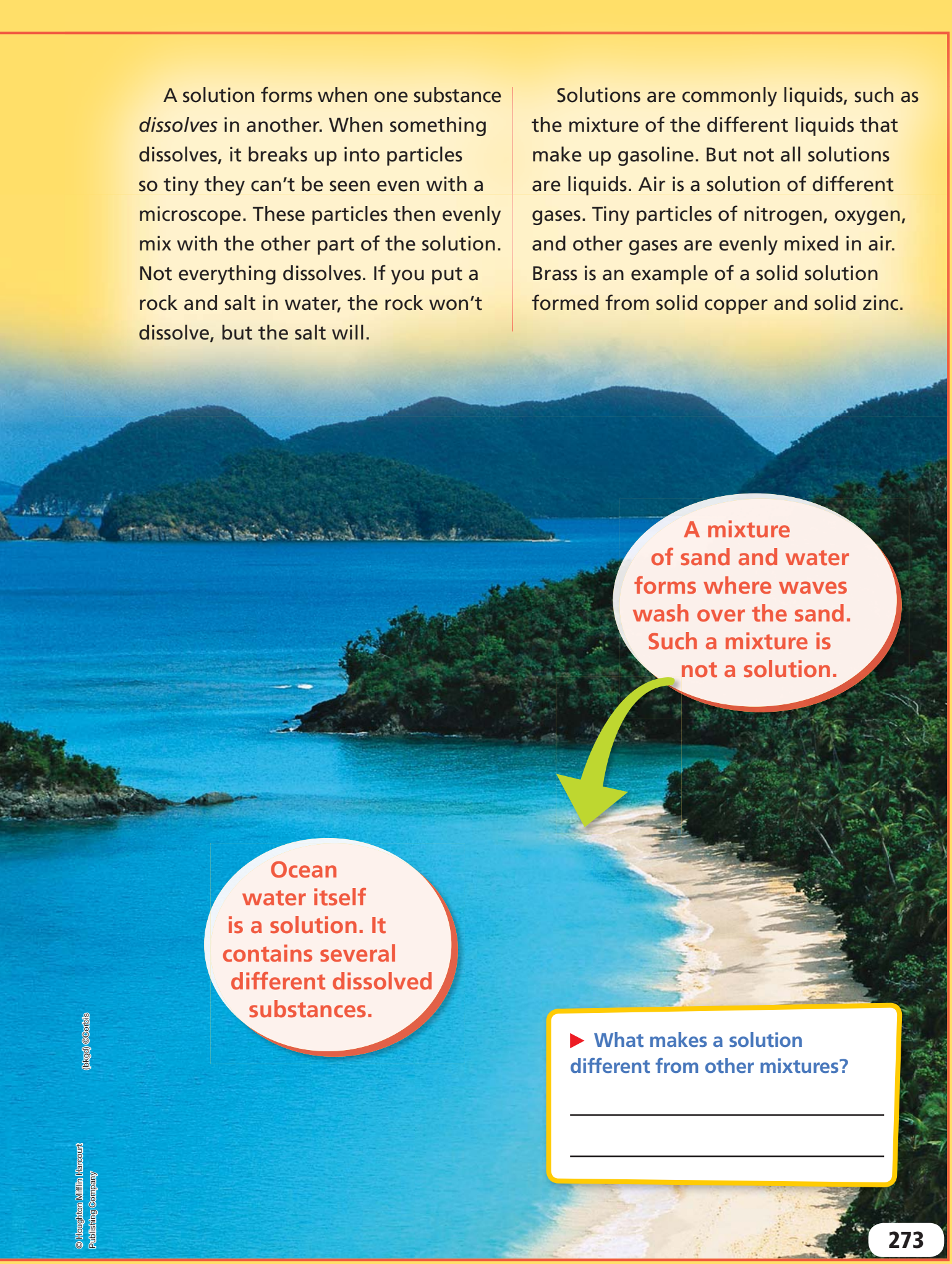
Each bite of fruit salad contains different combinations of fruit. You can separately taste peaches and different kinds of berries. But what do you notice when you drink a glass of lemonade? Every sip tastes the same. This is because lemonade is a solution. A **solution** is a mixture that has the same composition throughout.



When food coloring is added to water, the two liquids evenly mix, forming a solution.

A solution forms when one substance *dissolves* in another. When something dissolves, it breaks up into particles so tiny they can't be seen even with a microscope. These particles then evenly mix with the other part of the solution. Not everything dissolves. If you put a rock and salt in water, the rock won't dissolve, but the salt will.

Solutions are commonly liquids, such as the mixture of the different liquids that make up gasoline. But not all solutions are liquids. Air is a solution of different gases. Tiny particles of nitrogen, oxygen, and other gases are evenly mixed in air. Brass is an example of a solid solution formed from solid copper and solid zinc.



A mixture of sand and water forms where waves wash over the sand. Such a mixture is not a solution.

Ocean water itself is a solution. It contains several different dissolved substances.

▶ What makes a solution different from other mixtures?

_____

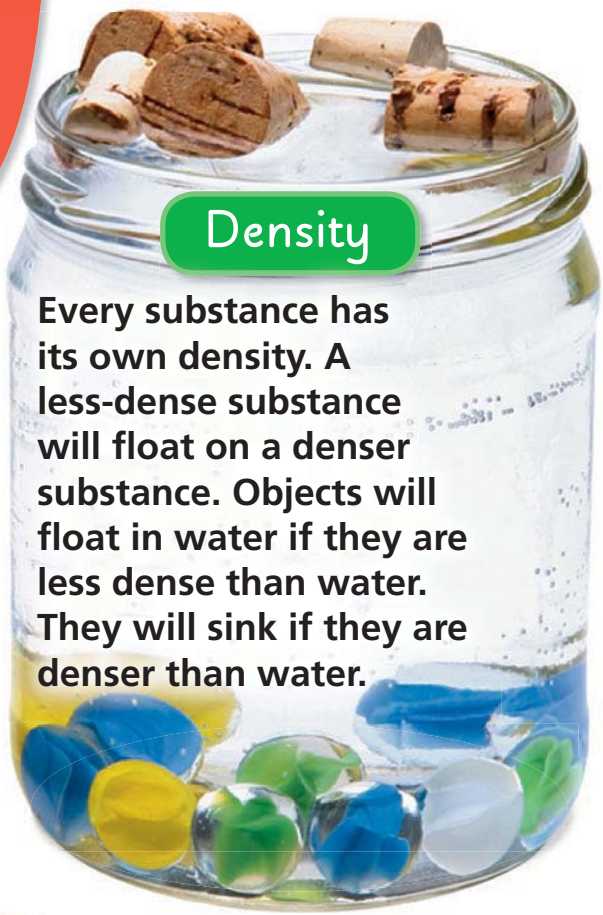
_____

# Separating Mixtures

Suppose you really don't like olives. How are you going to get them off that deluxe pizza your friend ordered? Sometimes you need to separate the components of a mixture.

**ACTIVE READING** As you read this page, put brackets [ ] around the sentence that describes the problem and write *P* next to the sentence. Underline the sentence that describes the solution and write *S* next to it.

Mixtures are not always easy to separate. But since mixing is a physical change, each component in a mixture keeps most of its physical properties. Physical properties such as color, size, melting point, boiling point, density, and ability to dissolve can be used to separate mixtures. Separating a mixture can be very simple. Or it can involve several, complex steps when one method is not enough.



## Density

**Every substance has its own density. A less-dense substance will float on a denser substance. Objects will float in water if they are less dense than water. They will sink if they are denser than water.**

▶ **What property was used to separate the items on this tray?**

_____

A magnet takes away bits of iron.

# When One Isn't Enough

## sieve/mesh screen

A sieve or mesh screen has holes that matter can pass through. Matter that is smaller than the holes passes through the mesh screen while matter that is larger than the holes stays above the mesh screen.

## magnetic force

A magnet attracts matter that contains iron, separating it from the other parts of the mixture.

## filtration

A filter works like a mesh screen with very tiny openings, or pores. Only the smallest bits of matter—like water particles and dissolved particles of salt—can pass through the pores.

## evaporation/boiling

Boiling is when a liquid rapidly changes to a gas at the boiling point of the liquid. Evaporation also changes a liquid to a gas, but it occurs at temperatures below the boiling point. During these processes, only the liquid particles leave the solution. Dissolved particles stay behind.

Water is added. Then the filter removes the soil.

The water is boiled away. Only salt is left behind.

Why It Matters

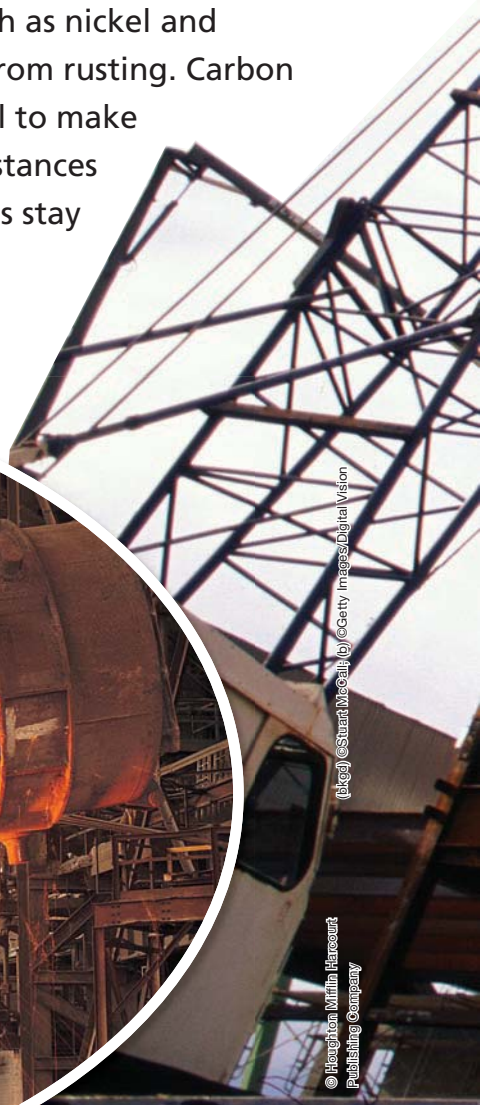
# Proportions and Properties

When you make lemonade, it's important to get the amounts of lemon and sugar right. If it's too sweet or too sour, it doesn't taste right. How do proportions affect the properties of a mixture?

Mixtures of metals are called *alloys*. The properties of the alloy depend on how much of each metal is in the mixture. Chemists first decide on the properties they need their alloy to have. Then they decide how much of which metals will give them those properties.

Steel is an alloy. It is made from iron and other substances. Different substances give steel different properties. For example, adding chromium will make steel shiny. Metals such as nickel and titanium can keep it from rusting. Carbon is often added to steel to make it stronger. Other substances help steel used in tools stay sharp or keep from wearing down.

**To make an alloy, metals and other elements are melted together and then allowed to harden.**



▶ For each steel object on this page, list at least two properties that the steel must have.

Kettle

Sculpture

Steel Building Frame

## DO THE MATH

**Use Graphs**

Compare and contrast the metals and other substances in stainless steel and tool steel by making two circle graphs.

| Substance | Stainless Steel % | Tool Steel % |
|---|---|---|
| Iron | 74 | 94 |
| Chromium | 18 | 0 |
| Nickel | 8 | 1 |
| Carbon | 0 | 1 |
| Other | 0 | 4 |