

# 2.1

## Solutes and Solvents



**Figure 1** This iced tea was made by dissolving iced tea powder in water.

**dissolve:** to mix one type of matter into another type of matter to form a solution

**solvent:** the larger part of a solution; the part of a solution into which the solutes dissolve

**solute:** the smaller part of a solution; the part of a solution that dissolves in the solvent

### LINKING TO LITERACY

#### During Reading: Comparisons

Comparisons are used to make clear what is the same and what is different about two or more items. As you read this section, compare characteristics of solvents and solutes. How are they similar? How are they different? How does making comparisons help you to better understand solvents and solutes?

Have you ever made iced tea by mixing a powder and water (Figure 1)? If so, did you use more powder or more water to make the drink? You probably mixed a lot of water with a small amount of powder. What kind of mixture is iced tea? It looks like a pure substance, but you know that it contains at least two components (water and tea). It is a homogeneous mixture, or solution. The powder mixes evenly, or **dissolves**, into the water to make the solution.

Most solutions are made by dissolving a small quantity of one type of matter into a much larger quantity of another type of matter. The part that is present in the larger quantity is called the **solvent**. The part that is present in the smaller quantity is called the **solute**. The solutes are the parts of the solution that dissolve. Solutions are generally made by dissolving one or more solutes in a solvent.

### Liquid Solutions

You are probably most familiar with solutions that are liquids. These all have liquid solvents. In food preparation, the solvents are usually liquids like water or vegetable oil. In iced tea, water is the solvent. Water is the most common solvent on Earth.

Other solvents, besides water, are also useful. Ethanol is the solvent in perfume. Turpentine is a solvent that is used with paints. Ethyl acetate is one of the solvents in nail polish (Figure 2).



**Figure 2** Ethanol, turpentine, and ethyl acetate are useful solvents for matter that does not dissolve in water.

The solutes that dissolve in liquids may be solids, liquids, or gases. Salt and sugar are common solid solutes. Acetic acid is a liquid solute that can be added to water to form vinegar. Gases such as carbon dioxide and nitrogen dissolve in our blood and are carried around our bodies. Can you think of other solids, liquids, and gases (solutes) that dissolve in liquids to form solutions?

## Water: The Universal Solvent

The water from your tap probably looks and tastes like pure water. Tap water is a solution that contains many solutes. These solutes include iron, aluminum, salt, fluorine, calcium, magnesium, and chlorine. How did they get into your tap water? As water flows in rivers and lakes and underground, it comes into contact with many types of matter (Figure 3). Gases from the air and minerals from the rocks and soil dissolve in the water. Pollutants may also dissolve in the water.



**Figure 3** As water flows in a stream, it dissolves many substances.

Before water reaches your tap, it is cleaned to make it safe for drinking. Chlorine and fluorine are sometimes added to the water. Chlorine kills bacteria, and fluorine may help keep your teeth healthy.

Water probably dissolves more different substances than any other solvent. For this reason, water is sometimes called “the universal solvent.” Water is the solvent in many important solutions. 🌐

### Water in Your Body

Your body is about 70 % water. All this water dissolves many different solutes, making a variety of solutions. The solutes include salt, oxygen, sugars, and mineral components such as calcium and potassium. These solutes are able to travel around your body because they are dissolved in water. Blood plasma, sweat, urine, and tears are common solutions produced by your body. Water is the solvent in all of these solutions.

### Water around Earth

About 70 % of Earth’s surface is covered by water. There is always about the same amount of water on Earth. Water from rivers and oceans evaporates into the air and then condenses to form clouds and precipitation (rain and snow). As water moves around Earth, it dissolves many different solutes. These solutes are transported to almost every part of the world. Figure 4 shows that solutes in water can be absorbed by living things.

To learn more about “the universal solvent,”

**Go to Nelson Science**



**Figure 4** Plants absorb the minerals and nutrients dissolved in water through their roots.

## Solid Solutions

Not all solutions are liquids. Solutions can also be solids. In a solid solution, both the solvent and the solute are solids. The gold used to make jewellery is often called “14 karat gold.” Pure gold is 24 karat gold, so 14 karat gold is made up of 14 parts of gold to 10 parts of other metals—generally silver, copper, nickel, or palladium (Figure 5). In this case, gold is the solvent and the other metals are the solutes.

Solid solutions are called “alloys” when they contain two or more metals. To make alloys, the metals are heated until they melt, and then they are mixed together and allowed to cool. Brass is an alloy of copper and zinc (Figure 6). Bronze is an alloy of copper and tin. In both brass and bronze, copper is the solvent. What are the solutes?



**Figure 5** Yellow gold is a solid solution of solutes (silver and copper) in a solvent (gold).



**Figure 6** Brass is an alloy (a solid solution) of copper and zinc.

### LINKING TO LITERACY

#### During Reading: Comparisons

You have now read about three different types of solutions: liquid, solid, and gas. How are these similar? How are they different? How does making comparisons help you to deepen your understanding of solutions?

## Gas Solutions

The air you breathe is about 78 % nitrogen gas, 21 % oxygen gas, and 1 % argon gas, along with smaller amounts of other gases like carbon dioxide. Air is therefore a solution that is a gas. What is the solvent of this solution? What are the solutes?

In all gas solutions, both the solvent and the solutes are gases. Other gas solutions include the gasoline-air mixture in a car engine, and the perfume that you may smell in the air as someone walks by you.



### TRY THIS: Identify Solutions at Home

#### SKILLS MENU: observing, analyzing, communicating

There are many household products that you use everyday. Can you tell which ones are solutions?

1. Search at home for two liquid solutions, two solid solutions, and two gas solutions. Examples might include clear shampoo, cleaning products, medicines, clear juices, gold jewellery, objects made of brass, bronze, or steel, and anything that you can smell!



To smell any substance, hold it away from you and, using your hand, waft the scent toward your nose. Never directly inhale an unknown substance.

- A. Try to identify the solvent and the solute for each solution. If they are not listed on a label, use the Internet to help you find out. Remember that the solvent is always the largest ingredient in a solution. To learn more about the contents of household products,

Go to Nelson Science



- B. Present your discoveries in a table.



## Water Pollution

Plants and animals get some of the nutrients they need from water. However, water can dissolve pollutants, too. **Pollution** includes any pure substance or mixture that contaminates the natural environment. Polluted water is a mixture of pure water and pollutants. Figure 7 shows how pollutants can enter water from various sources.

**pollution:** contaminants in the environment that could harm living things

It is very important to keep the water in our lakes, rivers, and oceans clean, so that organisms can grow and live there normally. We all have to be careful not to let contaminants get into our water.

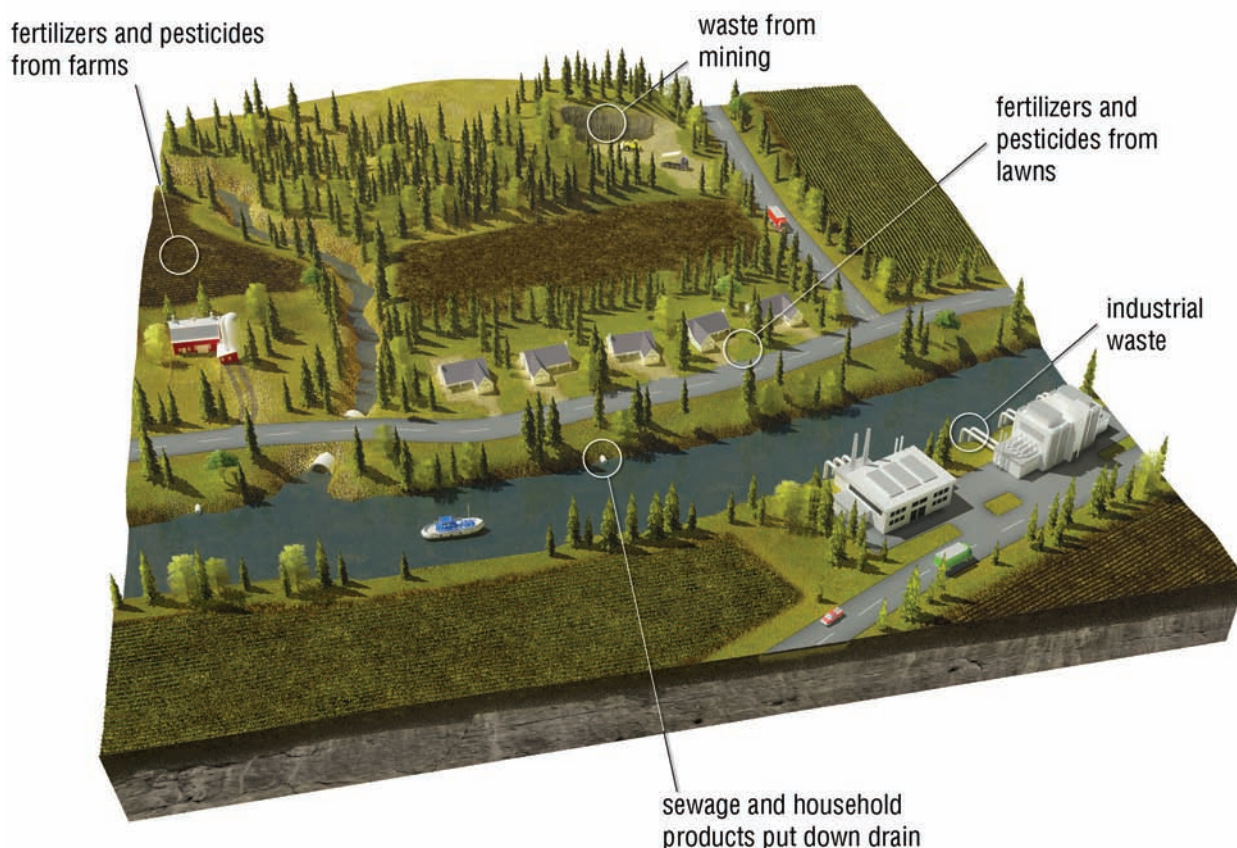


Figure 7 Sources of water pollution

### Unit Task

How will you use the information about solutes and solvents in this section when you start to work on the Unit Task?



### CHECK YOUR LEARNING

1. In your own words, define solute and solvent.
2. Ocean water is a solution. It contains about 96 % water, 4 % salt, and very small amounts of other salts and minerals.
  - (a) What is the solvent in ocean water?
  - (b) What are the solutes in ocean water?
3.
  - (a) List one solution that is a solid, one solution that is a liquid, and one solution that is a gas.
  - (b) For each solution, describe the solvent and the solute(s).
4. A sealed bottle of soda water contains carbon dioxide gas dissolved in water. When you open the bottle, the gas bubbles out of the solution.
  - (a) What is the solvent in soda water? How do you know?
  - (b) What is the solute?
5. How is water an important solvent in the body?
6.
  - (a) What is pollution?
  - (b) Name four ways that pollutants enter water.