LESSON CLUSTER 5
Explaining Dissolving

Lesson 5.1: How Did the Sugar Get Out?

A long time ago, in Lesson Cluster 2, you studied pure substances and mixtures. Do you remember the difference? Pure substances, like pure water and pure oxygen, are made of only one kind of molecule. Mixtures, like salt water and air, contain several different kinds of molecules.

This is a lesson cluster about mixtures. One kind of mixture is formed by dissolving a solid in a liquid. When a solid dissolves in a liquid, the molecules of the liquid hit the solid, breaking apart the solid into invisibly small molecules. These molecules spread evenly throughout the liquid.

In this lesson cluster you will dissolve several solids in water, you will find out how to make solids dissolve faster or slower, and you will learn to explain what happens to the molecules of both the liquid and solid in dissolving. The first step, though, is to watch something dissolve and describe what you see. So let's get started!

****

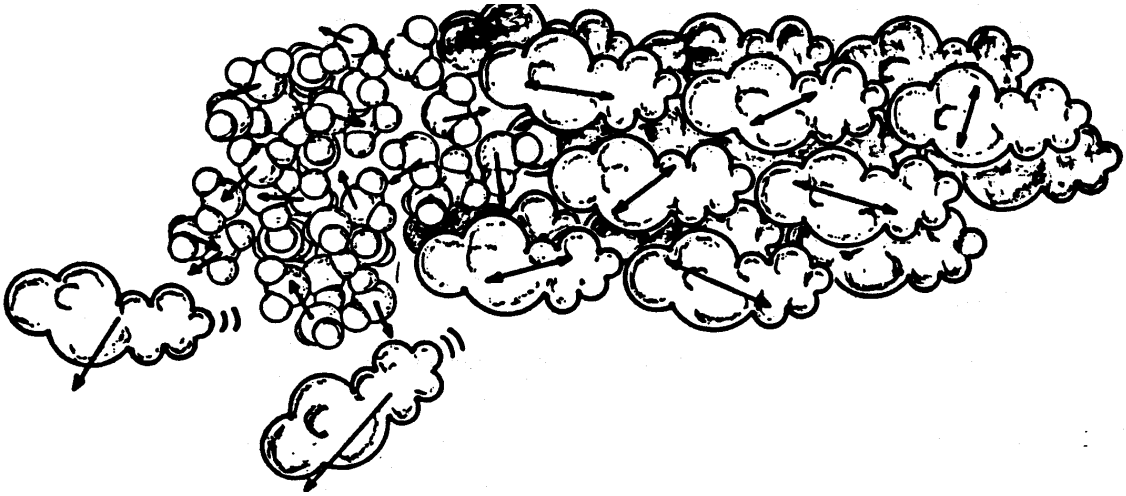
Do Activity 5.1 in your Activity Book

****

Did you say that you could see wavy lines under the tea bag and taste the sugar in the water? That is true. We cannot see the tiny molecules of sugar or the tiny molecules of water; but we can taste the sugar in the water. The sugar did not disappear, but the sugar grains broke into separate, tiny molecules, so that we could no longer see the sugar. Just because we cannot see the sugar does not mean it is not there. The water tastes sweet, so it must still be there.

How did the sugar get out the tea bag? You can answer this question if you think about the size of sugar molecules. The holes in the tea bag are much smaller than a grain of sugar, but much larger than a molecule of sugar or water. As the water molecules enter the tea bag and hit the solid sugar, the molecules of sugar break away rapidly and mix with the water molecules. The tiny molecules of sugar and water easily pass through the holes in the tea bag. The wavy lines

under the tea bag were caused by trillions of sugar molecules streaming from the solid sugar and mixing with the water molecules. As the sugar mixes more completely and spreads throughout the water, the wavy lines disappear



Sugar molecules break out of their rigid pattern and mix with water molecules

Now let's try to organize these ideas into an explanation. Remember the parts of an explanation you were introduced to in Lesson Cluster 4? We'll use those to organize our explanation.

- Question: How did the sugar get out of the tea bag?
- Substance: The water went into the tea bag and dissolved the sugar. Sugar-water came out of the tea bag and mixed with the rest of the water. (The wavy lines were made by the sugar-water coming out of the tea bag.)
- Molecules: The water molecules went through the holes in the tea bag, hit the grains of sugar, and broke off sugar molecules. The mixture of sugar molecules and water molecules went back out through the holes in the tea bag.

Lesson 5.2: Dissolving Fast and Slow

In the first lesson, you dissolved sugar in water. The sweet mixture of water molecules and sugar molecules is called a solution. Many different substances dissolve in water (or other liquids), so you can make many different solutions. Can you make substances dissolve faster or slower? How? Activity 5.2 will help you answer those questions.

****

Do Activity 5.2 in your Activity Book

****

My friend found a way of making the salt dissolve faster. She stirred one cup. The salt dissolved much faster in the cup that she stirred than in the other one.

Let's try explaining why her method worked, using our guide for explanations.

- Question: Why did stirring cause the salt to dissolve faster?

- Substances: She stirred the mixture and water rushed around the grains of salt.

- Molecules: Stirring caused more molecules of water to hit the salt grains, so the molecules of salt were broken off from the grains faster.

How did my friend's method compare with your method? Look at the explanation above and compare it with the explanation you wrote in your activity book. Do you see any ways that you could make your explanation better?

Lesson 5.3: Complex Solutions

In Activity 5.2 you made a solution by dissolving both salt and sugar in water. We call solutions like that complex solutions: they contain more than one dissolved substance.

There are many complex solutions. For example, grape Kool-Aid drink has sugar, purple color, and grape flavoring all dissolved in water. Ocean water is another example. It contains not only salt, but many other substances dissolved in it. If you took ocean water, filtered out all the dirt, placed it in a pan, and let the water evaporate, you would get many salt crystals, but you would also get a variety of other kinds of crystals. Each kind of crystal indicates a different kind of substance.

You have also seen many other complex solutions, though you might not have known what they were. Honey is a complex solution. It consists mostly of water molecules and sugar molecules. That's why it is sweet. But the special flavor of honey comes from many other kinds of molecules that are mixed with the water and sugar. Syrup and ginger ale are also complex solutions. They both have water and sugar, plus other substances that give them their special flavors.

A grocery store is full of complex solutions. Sometimes the labels even tell you what substances have been mixed together to make them. You might try looking at the labels on bottles of mouthwash, or soda, or shampoo. They tell you what substances have been dissolved in water to make them.

Even our drinking water has a number of substances dissolved in it. If your city gets drinking water from a well, the water has come into contact with a variety of rocks containing various minerals. Most of these minerals dissolve in water to some extent. If your drinking water comes from a spring, a lake, or a river, the same is true. Most of the water that you see, therefore, has a number of solids dissolved in it. So the water we get from a faucet is not really pure; it is really a complex solution.

Now try answering some questions about complex solutions--and the other things you have studied in this lesson cluster.

****

Do Review Question Set 5.3 Now

****

This lesson cluster is just about over. Let's end it with a summary of some of the most important ideas. See how much of this summary is like the one you wrote in your answer to the last question.

Lesson 1 was about dissolving sugar. You learned that when sugar dissolves it breaks up into individual molecules. You also learned how dissolving takes place. The water molecules break molecules of sugar off the grains. The water molecules and the sugar molecules intermingle until the sugar molecules are spread evenly through the water.

In Lesson 2 you learned that you can make things dissolve faster by stirring, and you learned that stirring speeds up dissolving because it makes more molecules of water hit the sugar grains and break off sugar molecules faster.

In Lesson 3 you learned that many of the liquids around you are solutions, usually complex solutions that have several different substances in them.

Can you think of a way to make a solid dissolve faster in water <u>without</u> stirring? Without even touching the cup? That is one thing you will learn about in Lesson Cluster 6.