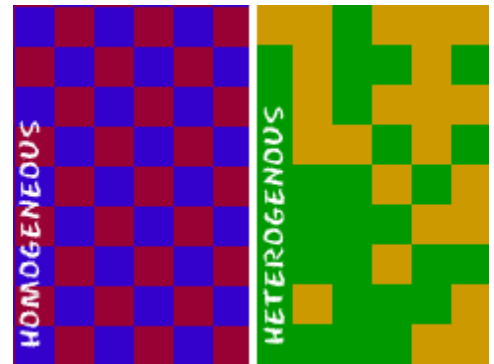


## Solutions

Before we dive into **solutions**, let's separate solutions from other types of mixtures. Solutions are groups of molecules that are mixed and evenly distributed in a system. Scientists say that solutions are **homogenous systems**. Everything in a solution is evenly spread out and thoroughly mixed. **Heterogeneous mixtures** have a little more of one thing (higher concentration) in one part of the system when compared to another.



Let's compare sugar in water (H<sub>2</sub>O) to sand in water. Sugar dissolves and is spread throughout the glass of water. The sand sinks to the bottom. The sugar-water is a homogenous mixture while the sand-water is a heterogeneous mixture. Both are mixtures, but only the sugar-water can also be called a solution.

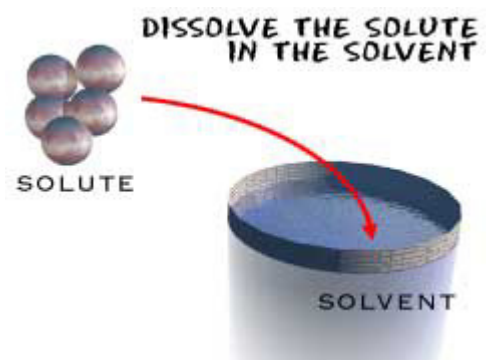
## Can anything be in a Solution?

Pretty much. Solutions can be solids **dissolved** in liquids. When you work with chemistry or even cook in your kitchen, you will usually be dissolving solids into liquids. Solutions can also be gases dissolved in liquids, such as carbonated water. There can also be gases in other gases and liquids in liquids. If you mix things up and they stay at an even distribution, it is a solution. You probably won't find people making solid-solid solutions. They usually start off as solid/gas/liquid-liquid solutions and then harden at room temperature. Alloys with all types of metals are good examples of solid solutions at room temperature.

SOLUTION	EXAMPLE
Gas-Gas	Air
Gas-Liquid	Carbon Dioxide (CO <sub>2</sub> ) in Soda
Gas-Solid	Hydrogen (H <sub>2</sub> ) in Palladium (Pd) Metal
Liquid-Liquid	Gasoline
Liquid-Solid	Dental Fillings
Solid-Solid	Metal Alloys Such as Sterling Silver

## Making Solutions

A simple solution is basically two substances that are evenly mixed together. One of them is called the solute and the other is the solvent. A **solute** is the substance to be dissolved (sugar). The **solvent** is the one doing the dissolving (water). As a rule of thumb, there is usually more solvent than solute. Be patient with the next sentence as we put it all together. The amount of solute that can be dissolved by the solvent is defined as **solubility**. That's a lot of "sol" words.



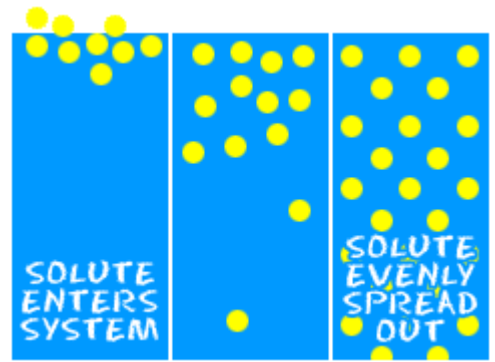
## Making Solutions

So, what happens? How do you make that **solution**? Mix the two liquids and stir. It's that simple. Science breaks it into three steps. When you read the steps, remember...

Solute= Sugar

Solvent= Water

System= Glass.



1. The **solute** is placed in the **solvent** and the concentrated solute slowly breaks into pieces. If you start to stir the liquid, the mixing process happens much faster.
2. The molecules of the solvent begin to move out of the way and they make room for the molecules of the solute. Example: The water has to make room for the sugar molecules to spread out.
3. The solute and solvent interact with each other until the concentration of the two substances is equal throughout the system. The concentration of sugar in the water would be the same from a sample at the top, bottom, or middle of the glass.

## Can Anything Change Solutions?

Sure. All sorts of things can change the **concentrations** of substances in solution. Scientists use the word **solubility**. Solubility is the ability of the solvent (water) to dissolve the solute (sugar). You may have already seen the effect of **temperature** in your classes. Usually when you heat up a solvent, it can dissolve more solid materials (sugar) and less gas (carbon dioxide). If your friend was mixing sugar and water, she would be able to dissolve a lot more sugar into hot water rather than cold.

Next on the list of factors is **pressure**. When you increase the surrounding pressure, you can usually dissolve more gases in the liquid. Think about your soda can. It is able to keep the fizz inside, because the contents of the can are under higher pressure. Think about a bottle of soda. The first time you open the bottle, a lot of bubbles come out. If you open and close it over a few hours, fewer and fewer bubbles will come out of the solution. When you opened the bottle the first time, you lost the high pressure that was keeping the carbon dioxide (CO<sub>2</sub>) gas in solution.



Last is the **structure** of the substances. Some things dissolve easier in one kind of substance as opposed to another. Sugar dissolves easily in water and oil does not. Water has a low solubility when it comes to oil. Since oil is not soluble in water, it will never truly dissolve. Oil and water is a mixture, not a solution. The two types of molecules (oil and water) are not evenly distributed in the system.