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## solution

A true solution is a mixture of two or more different substances that cannot be separated by settling, filtering, or other mechanical means. In the case of a water-and-sugar solution, for instance, the sugar will not settle to the bottom of the glass nor can it be removed by filtering. When going into solution, the sugar crystals break up into tiny particles called molecules (see [molecule](#)). These sugar molecules become evenly distributed among the water molecules so that a uniform liquid results.

Solutions differ from substances known as colloids. When particles dissolve to form a solution, they break up into individual molecules or ions, whereas colloid particles consist of clusters of molecules. Fog, smoke, milk, and gelatin are familiar examples of colloids (see [colloid](#)).

In solutions the solvent, frequently a liquid, is the substance in which another substance dissolves (see [solvent](#)). The dissolved substance is called the solute. It may be a solid (as in the sugar solution), a liquid (as when alcohol and water are mixed), or a gas. Mixtures of two solids, as when two metals are combined in an alloy (such as copper and zinc combined to form brass), are sometimes called solid solutions.

Some substances that form solutions break down into particles finer than molecules. In a solution of common table salt and water, for example, many of the salt molecules are divided into fragments called ions—an atom or group of atoms with a positive or negative electric charge. Chief among the substances that form ionized solutions are acids, bases, and salts. Ionized solutions conduct electricity and are very active chemically. They are known as solutions of electrolytes, while solutions composed of molecules that do not bear an electric charge are solutions of nonelectrolytes. (See also [acid and base](#); [battery and fuel cell](#); [electrochemistry](#).)

In order to break down an electrolyte into ions, the solvent must have a strong ability to decrease the forces of attraction and repulsion of the charged particles. [Water](#) is the most common solvent for electrolytes. (The ocean itself is an example of an electrolyte solution.) Among the other substances used as solvents for electrolytes are ammonia and sulfur dioxide.

The amount of a substance that can be dissolved in a given quantity of solvent is a measure of the substance's **solubility**. This ability of a solute to dissolve in a solvent depends primarily on the chemical properties of both substances. Temperature also often affects **solubility**, and pressure sometimes does. The **solubility** of solids almost always increases when the solvent is heated. For example, more than twice as much sugar will dissolve in a quantity of boiling water as will dissolve in the same amount of ice-cold water. On the other hand, the **solubility** of gases decreases as the temperature of the solvent rises. When solids or liquids go into solution, they raise the boiling point of the solvent and lower its freezing point.

The **solubility** of one liquid in another may be partial or complete. The strength, or concentration, of a solution is commonly indicated by a percentage. A 5 percent salt solution indicates that the solution contains 5 parts by weight of salt to 95 parts by weight of water.

When a liquid at a given temperature has dissolved all of a substance that it can hold, the solution is said to be saturated. Ordinarily, as a hot, saturated solution of a solid cools, some of the dissolved substance comes out of solution and resolidifies, forming crystals on the side of the container or dropping to the bottom as a precipitate. In certain cases the surplus remains in solution after the liquid has cooled, creating a supersaturated solution. Jarring or agitating the liquid or dropping a fragment of the dissolved material into it will usually cause the surplus material to solidify suddenly.

Solutions are involved in most chemical reactions and play an essential role in life processes. Air, for example, is a solution of oxygen and nitrogen with small amounts of other gases. Oxygen taken into the lungs goes into solution in the blood, unites chemically with the hemoglobin in red blood cells, and is released to body tissues (see [respiratory system](#)). Chemical industries take advantage of the properties of solutions for many processes, including separation and purification. Many common inorganic chemicals, for example, are obtained by extracting crystals out of a water solution. (See also [chemistry](#).)

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