**Science Summer Reading**

Adapted from <https://courses.lumenlearning.com/introchem/chapter/substances-and-mixtures/>

**Matter**

Matter is divided into two classifications: Pure Substances and Mixtures.

**Pure Substances**

In chemistry, a pure substance is a form of matter that has constant chemical composition and characteristic properties. It cannot be separated into components without breaking chemical bonds. Pure substances can be **elements** or **compounds**. Pure substances can be solids, liquids, or gases. Changes in temperature or pressure can cause pure substances to shift between the different phases of matter.

An element **(1)** is a pure substance that is made up of only one particular kind of atom, and therefore cannot be transformed by a chemical reaction into a different element. All atoms of an element have the same number of protons, though they may have different numbers of neutrons and electrons.

A compound **(2)** is made of two or more different elements that are connected by chemical bonds. The elements **combine chemically (3)** into one substance through a chemical reaction to form a chemical compound. The chemical reaction changes the starting materials into a NEW compound with different properties than the starting materials. All compounds are pure substances, but not all pure substances are compounds.

A pure substance always has the same properties and the same ratio of each element. Pure water is a chemical substance made of 2 hydrogen atoms and one oxygen atom bonded together. Pure water always has the same properties and the same ratio of hydrogen to oxygen whether it is isolated from a river or made in a laboratory. Examples of pure substances are:

* diamond (a form of carbon)
* gold
* table salt (sodium chloride)
* refined sugar (sucrose)
* pure water

Sometimes something that looks like a pure substance is in fact a mixture of pure substances. For example, tap water looks like pure water, but may contain small amounts of dissolved salt, calcium compounds, and many other chemical substances. Distilled water is a pure substance, but seawater, since it contains many complex molecules, is a mixture.

**Chemical Mixtures**

A mixture is made up of two or more different substances which are mixed but NOT combined chemically. A mixture refers to the **physical combination** **(4)** of two or more substances. In contrast to a pure substance, a mixture can have changing ratios of the different parts. For example, a sugar water mixture can be made using a lot of sugar or a little sugar, but it is still sugar water. The identities of the individual substances in a mixture are retained – a sugar water mixture contains sugar and water. A mixture can be separated into the component parts without breaking chemical bonds. Mixtures take the form of alloys, solutions, suspensions, and colloids.

## Heterogeneous Mixtures

A heterogeneous mixture **(5)** is a mixture of two or more pure substances (elements or compounds), where the different components CAN be visually distinguished. A heterogeneous mixture is formed from substances with very different appearance, such as marbles and toothpicks, or when the different components do not mix together evenly, such as oil and water. Examples include:

* oil and water
* sand and water
* river water
* pepperoni pizza
* trail mix
* vegetable soup

## Homogenous Mixtures

A homogeneous mixture **(6)** is a mixture of two or more pure substances (elements or compounds), where the different components CANNOT be visually distinguished. A homogeneous mixture looks like a pure substance because the different parts are equally spaced out throughout the whole mixture, like food coloring in water after it is mixed. Examples include:

* salt water
* rubbing alcohol (it is a mixture of water and alcohol)
* stainless steel (it is a mixture of different metals)
* Gatorade
* air
* tap water (it contains minerals, and sometimes additives, like fluoride)