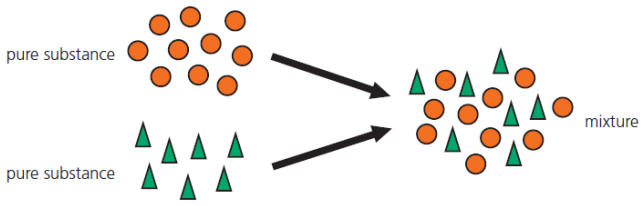
Substances and Mixtures

- A substance that contains only one kind of particle is called a **pure substance** (diamond, aluminum foil, table sugar)
- A **mixture** contains two or more pure substance Mixtures can be any combination of solids, liquids, and gases (Breads are mixtures of yeast, flour, sugar, water, air, and other chemicals)
- **mechanical mixture -** a mixture in which the different parts can be seen
- **solution -** the act of being dissolved
- A simple solution is basically two substances that are going to be combined. One of them is called the **solute**. A solute is the substance to be dissolved (sugar). The other is a **solvent**. The solvent is the one doing the dissolving (water). A **solvent** is a liquid or gas that dissolves a solid, liquid, or gaseous solute, resulting in a solution. As a rule of thumb, there is usually more solvent than solute.
- **unsaturated**: This means that if you were to add more solute to the liquid, it would keep dissolving. For example, if you take one teaspoon of salt and put it in a bucket of water, you've made an unsaturated solution. (In other words, if you added another teaspoon of salt, it would dissolve, too). An unsaturated solution is one in which more of the solute could dissolve at the same temperature.
- **saturated**: This means that the liquid has dissolved all of the solute that is possible. If any of you have a little brother or sister who adds sugar to iced tea, you know what I'm talking about. If you add one teaspoon of sugar to iced tea, you've got an unsaturated solution. If you keep adding sugar to iced tea, you eventually get to the point where the rest of the sugar just sinks to the bottom. When this happens, it means that the solution is saturated, because no more sugar could dissolve. A saturated solution is one in which no more of the solute will dissolve at a specific temperature.



Type of Mixture	Example
gas in gas	The atmosphere is a mixture of gases, mostly nitrogen and oxygen.
liquid in liquid	Wine is a mixture of mostly ethanol and water.
solid in solid	Alloys, such as brass, are made up of a mixture of metals.
gas in liquid	Soft drinks, such as cola, are mixtures of mainly carbon dioxide gas and water.
solid in liquid	Sea Water is a mixture of salts dissolved in water.
solid in gas	Smoke is mixture of tiny solid particles in atmospheric gases.

Solute	Solvent	Types of solutions	Examples
Solid	Solid	Solid in solid	Alloys
Liquid	Solid	Liquid in solid	Hydrated salts
Gas	Solid	Gas in solid	Dissolved gases in minerals
Solid	Liquid	Solid in liquid	Salt solution in water
Liquid	Liquid	Liquid in liquid	Alcohol in water
Gas	Liquid	Gas in liquid	Aerated drinks
Solid	Gas	Solid in gas	Iodine vapours in air
Liquid	Gas	Liquid in gas	Humidity in air
Gas	Gas	Gas in gas	Air

Some methods for separating the components of a mixture include:

separation technique	property used for separation	example
Sifting (sieving)	particle size	alluvial gold is separating from smaller soil particles using a sieve
Visual Sorting	colour, shape or size	gold nuggets can be separated from crushed rock on the basis of colour
Magnetic Attraction	magnetism	magnetic iron can be separated from non-magnetic sulfur using a magnet
Decanting	density or solubility	liquid water can be poured off (decanted) insoluble sand sediment less dense oil can be poured off (decanted) more dense water
Separating Funnel	density of liquids	in a separating funnel, less dense oil floats on top of more dense water, when the valve is open the water can be poured out from under the oil
Filtration	solubility	insoluble calcium carbonate can be separated from soluble sodium chloride in water by filtration
Evaporation	solubility and boiling point	soluble sodium chloride can be separated from water by evaporation
Crystallization	solubility	slightly soluble copper sulfate can be separated from water by crystallization
Distillation	boiling point	ethanol (ethyl alcohol) can be separated from water by distillation because ethanol has a lower boiling point than water

Types of Solutions

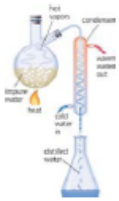
Example	Solute	Solvent
air (hydrogen in oxygen) →	gas	gas
pop (carbon dioxide in water) →	gas	liquid
antifreeze (alcohol in water) vinegar (acetic acid in water)	liquid	liquid
dental fillings amalgams	liquid	solid
salt or sugar in water →	solid	liquid
brass (copper in zinc) solder (tin in lead) alloys like steel (carbon in iron)	solid	solid

Separation of Mixtures

Solutions and mechanical mixtures can be separated in many ways.

1. **Evaporation**: the liquid evaporates and a solid (residue) is left behind.

2. **Distillation**: a two step process that:
   a) heats a solution to change one part into gas and then,
   b) cools the gas/vapour to liquid form and collects it



3. **Filtration**: the use of a funnel and filter paper to separate a solid from a liquid. The liquid passes through the filter paper and is called filtrate. The solid remains in the filter paper and is called residue.

4. **Sifting**: using a sieve, different sized substances can be separated.

5. **Magnetism**: a magnet can be used to remove metal from non-metallic substances.