STUDY NOTES- MIX AND FLOW OF MATTER TOPIC 1-3

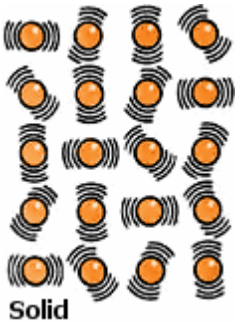
WHAT IS MATTER?

'Matter' refers to all substances that make up the universe. Matter is everywhere.

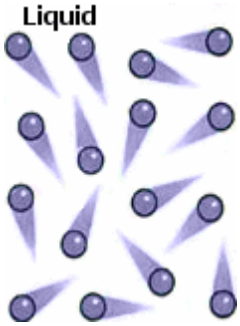
Matter is made up of tiny particles that are constantly moving. There are attractive forces between these particles holding them together. The more energy these particles have, the faster they move.

SOLIDS, LIQUIDS AND GASES

In a solid,



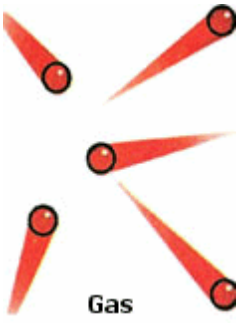
- particles are strongly attracted to each other and are not able to move about freely
- shape and volume do not change in a solid.



In a liquid,

- particles have more energy so they are able to move over each other
- the shape of the liquid can change, but the volume is fixed.
- liquids will take up the shape of the container they are in.

In a gas

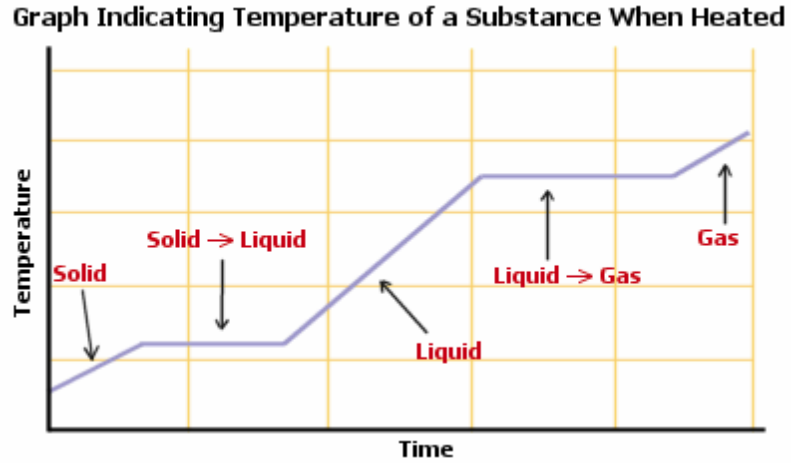


- particles have a lot of energy
- move in all directions at high speed.
- particles will move around and fill whatever container they are in.
- both the shape and the volume of the gas can be changed.
- because particles in a gas are much further apart they can be squashed into a smaller space. This is called compression

CHANGING STATE

Solids, liquids and gases can change state when energy is given to or taken from the particles.

The graph below shows what happens to the temperature of water as energy (in the form of heat) is added to it.



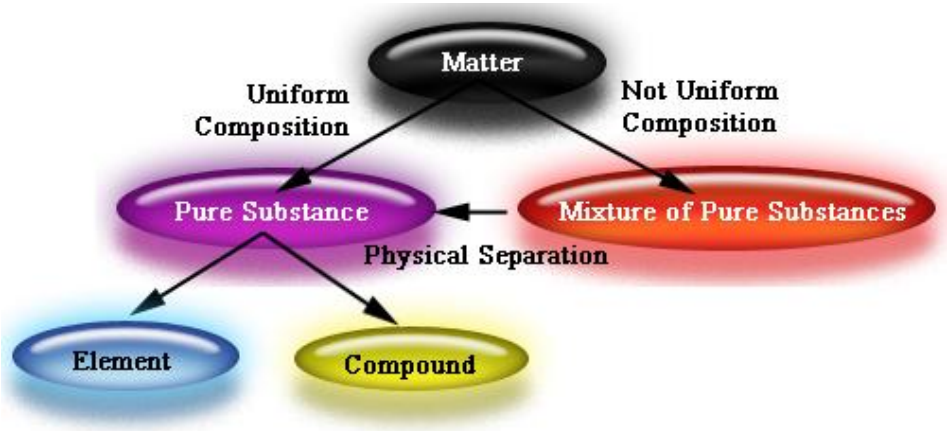
As ice is heated, the particles gain more energy. This process is called *melting*.

If you continue to heat the liquid, the particles are given more energy and the liquid becomes a gas. This process is called *vaporization.*

If water loses energy(heat is taken away), it will change states. Look at the diagram below to see the changes.

ELEMENTS, COMPOUNDS AND MIXTURES

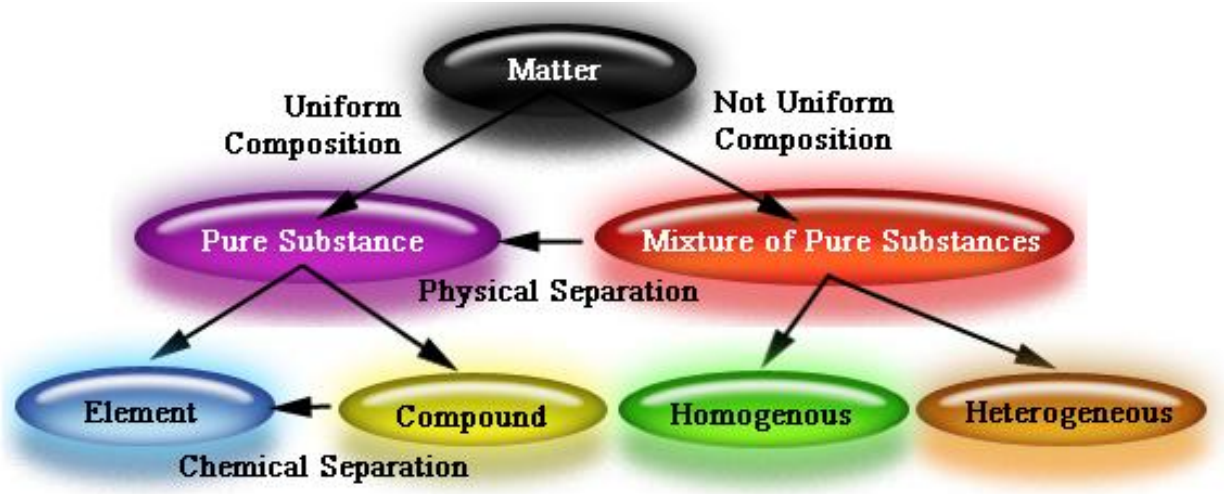
Matter can be a pure substance or a mixture. Pure substances can be an element or a compound.



- An element is a substance that cannot be broken down into simpler substances. Examples are gold, oxygen, carbon
- Elements can combine in different ways to form millions of compounds. For example, water is a compound made up of two elements combined together — hydrogen and oxygen.
- Mixtures can be made from all sorts of materials; solids with solids, liquids with liquids, gases with gases, solids with liquids and gases with liquids.

Most of the solids you see are mixtures. Most rocks are mixtures of many elements and compounds. Concrete is a good example of a man-made solid mixture.

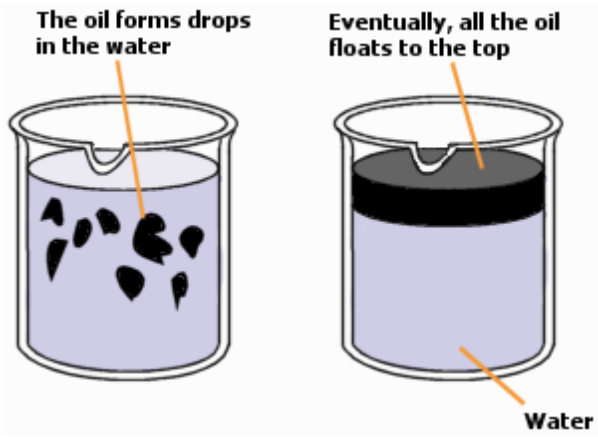
Mixtures can be homogeneous (appear to be one substance) or heterogeneous (can see two or more parts).



Homogeneous and Heterogeneous Mixtures

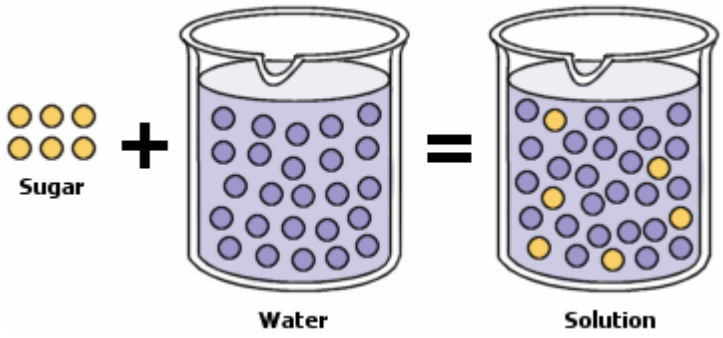
When you mix two liquids together, they may dissolve in each other. This will result in a single layer.

- For example, if you add water to alcohol, the resulting mixture remains as one layer.
- Some combinations of liquids, like oil and water, do not dissolve in each other. When you mix them together the resulting mixture remains as two separate layers.



Solutions

When you mix a solid and a liquid together, if the solid dissolves in the liquid, the resulting mixture is



called a solution. In the case of sugar and water, the sugar is the *solute* and the water is the *solvent*.

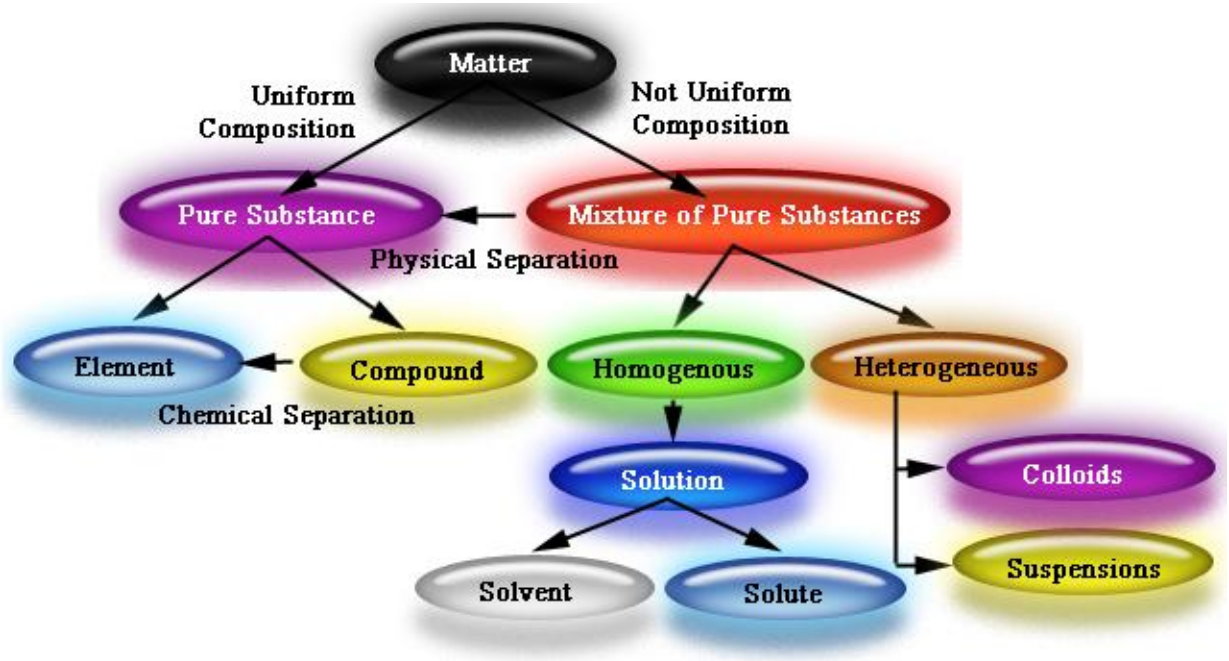
Some gases can also dissolve in some liquids forming solutions.

In between mixtures

If the solid does not dissolve in the liquid, but settles slowly, the mixture is called a suspension. (Example- Italian salad dressing).

If the particles do not settle but the mixture is heterogeneous, it is called a **colloid**. Colloid particles are very small.

An emulsion is a colloid that has an emulsifying agent added to it so it stays in a mixture longer (e.g. milk and mayonnaise)



Solubility Graphs

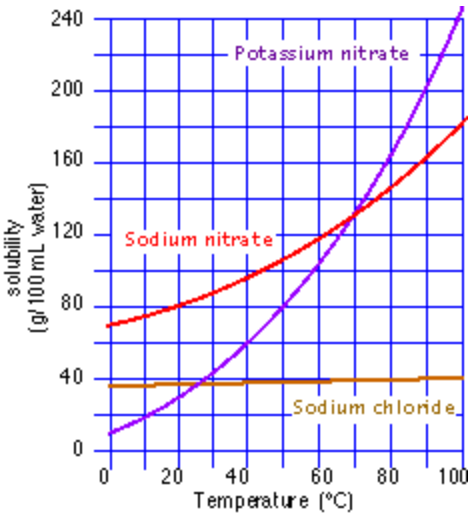
There are charts and tables available that we can use to get an idea of how soluble a certain solute is in a certain solvent.

Solubility curves tell us what mass of solute will dissolve in 100g (or 100mL) of water over a range of temperatures. You'll notice that for most substances, solubility increases as temperature increases. In solutions involving liquids and solids typically more solute can be dissolved at higher temperatures.

On a solubility curve, the lines indicate the concentration of a **saturated solution** - the maximum amount of solute that will dissolve at that specific temperature.

Values on the graph below a curve represent **unsaturated solutions** - more solute could be dissolved at that temperature.

Values above a curve represent **supersaturated solutions,** a solution which holds more solute that can normally dissolve in that volume of solvent.



Dissolving is affected by stirring, temperature, type of solvent and solute, and particle size.

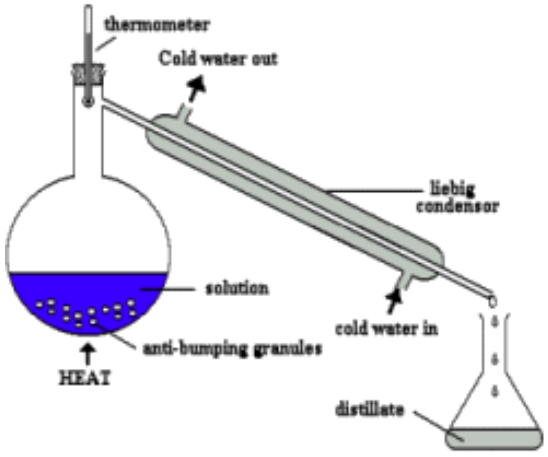
Separating Mixtures

Mixtures can be separated by a variety of ways

- Dissolving one substance but not the other.
- Filtration (using filters)
- Attracting one of the substances but not the other (use magnets).
- Picking apart the bits and pieces (mechanical separation)
- Floating and sinking the parts in water (density differences)
- Evaporating one part
- Crystallizing one part
- Distilling a solution to recover the solvent
- Chromatography

Separation methods depends upon the properties of the substance and what you want to recover.

EG. Distillation recovers the solute and the solvent
Evaporation (dehydration) recovers only the solute



distillation