Vocabulary:

*Matter:* has mass and takes up space (pure substances and mixtures)

*Pure Substances:* composition definite, **elements and compounds**

*Elements* –
- made up of the 1 kind of atom
- can’t be broken down into a simpler substance
- on the periodic table
- example: oxygen, copper, iron
Compounds –

- two or more elements chemically combined, example: NaCl (sodium and chlorine = salt).
- Often ends in “ide”
- Have a definite and fixed ratio, in water there are 2 hydrogens and 1 oxygen (H2O)
- Compound has different properties than the elements its made of. Ex: NaCl, Sodium or Na is a metal, while Chlorine is a poisonous gas…but when chemically combined, they form salt…which we eat!

Mixtures: composition variable (homogeneous or heterogeneous).

Mixtures are formed simply by blending two or more substances together in some random proportion without chemically changing the individual substances in the mixture. Mixtures can be separated because they are only physically bonded, not chemically bonded.

Mixtures can then be broken down into homogeneous and heterogeneous.

- A homogeneous mixture or solution: these are well mixed, where you can’t see the particles and they have a constant composition throughout.
  - Examples: salt-water, kool-aid, air we breathe, alloys (metal mixtures),
  - Can be two gases (air), two liquids, gas in liquid (carbon dioxide in soda), solid in liquid (salt in water), or two solids (an alloy, gold and copper)
  - Solute: the substance being dissolved
  - Solvent: the substance doing the dissolving. Water is a polar molecule (positive on one end and negative on the other) and is known as the universal solvent.
  - Non-polar solvents are toxic, flammable and generally dangerous.
  - Colloid: a type of mixture with larger particles, but they are not heavy enough to settle out. A way to detect a colloid is that you can see light scatter through them. (in regular solutions, you can’t see light through them).
    - Examples: milk, fog, Jell-O
    - The scattering of light by colloids is called the Tyndall Effect.

- A heterogeneous mixture: These have areas with differing compositions, and are not well-mixed (you can usually see the separation of the different substances).
Examples: salt with sugar (no water), water with gasoline or oil, salad, trail mix, stew, Raisin Bran cereal

- Suspension: a heterogenous mixture containing a liquid in which visible particles settle.
  - Example: Pond water, orange juice with pulp

Some ways to speed up the rate of dissolving in most solutions:

- Stirring
- Temperature
- **the exception to these rules are if you are dissolving a gas in a liquid. Gases dissolve faster if a liquid is cooled.**

Some ways to separate mixtures:

- Evaporation
- Distillation
- Centrifuge
- Filter/sort
- Magnetism

### Physical and Chemical Properties/Changes

<table>
<thead>
<tr>
<th><strong>Physical Property</strong> (a characteristic of a material that you can observe without changing the identity of the substances that make up the material)</th>
<th><strong>Chemical Property</strong> (characteristic of a substance that indicates whether it can/cannot undergo a certain chemical change, anything that has to do with a reaction or inability to react)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td>Flammable/Combustible</td>
</tr>
<tr>
<td>Shape</td>
<td>Reaction to light</td>
</tr>
<tr>
<td>Size</td>
<td>Corrosive</td>
</tr>
<tr>
<td>Volume</td>
<td>Reaction to vinegar, acid, oxygen...any type of ability to react or not react</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Physical Change</strong> (no changes occur in the structure of the atoms or molecules composing the matter. The substance is still the same substance as it was before the physical change occurred)</th>
<th><strong>Chemical Change</strong> (rearrangement of bonds between the atoms occurs. This results in new substances with new properties).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rip/ tear/ cut</td>
<td>Burning</td>
</tr>
<tr>
<td></td>
<td>liquid, gas or solid</td>
</tr>
<tr>
<td>---------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>Color change</td>
<td>Boiling</td>
</tr>
<tr>
<td>Stretching /</td>
<td>Freezing</td>
</tr>
<tr>
<td>folding</td>
<td>Mix</td>
</tr>
</tbody>
</table>

**Some indicators of a chemical change are smell, burning, bubbles….but the only way to be sure a chemical change has occurred is if a new substance is formed.**

How does temperature affect chemical changes?

- Increasing the temperature will cause chemical changes to occur *faster.*
- Decreasing the temperature will cause chemical changes to occur *slower.*

**Law of Conservation of Mass:**

Matter: has mass, and takes up space

Mass: amount of matter in an object

*Law of conservation of mass:* matter, during a chemical change, can neither be created nor destroyed, it just changes form. Also applies to a physical change, since during a physical change matter is neither being created or destroyed, it may just look different.

**Properties of Water:**

*Properties of Water*

1. **Polar:** slight positive and negative charge – can dissolve substances (*The universal solvent*)
2. **High specific heat:** water resists changes in temperature, therefore water must absorb more heat energy to increase temperature.
   - Very important with cells because our cells release a lot of heat and water absorbs that heat which allows us to regulate cell temperatures. Very important in oceans and ocean life.
3. **Cohesion:** attraction among molecules of a substance.
   - Makes water molecules stick together.
   - Ex- beads on a car when it is washed
   - Spider walking on top of the water (surface tension).
4. **Adhesion:** attraction among molecules of different substances.
   - Water molecules stick to other things.
   - Ex- upward curve of the surface of the water-> graduated cylinder
   - Ex- plants transport water up their roots to their leaves.
**Biogeochemical cycles:**

**The Carbon Cycle:**

The carbon cycle is a complex biogeochemical cycles, where carbon moves by various processes through different reservoirs. In the above picture, the process represented by the letter A is respiration. Respiration is where carbon dioxide leaves plants or animals and enters the atmosphere. B represents the process of photosynthesis, where plants take in carbon dioxide to aid in the process where they can make sugars, or food. C represents a process called decay, where organic matter is broken down by tiny microbes and released as carbon into the geosphere, and/or the atmosphere.

Humans are affecting the carbon cycle in two major ways. The first is through land use. When we destroy forests of trees, this upsets the carbon flow in that area. The same thing is happening when we build massive buildings and parking lots, destroying natural vegetation. The second is through the burning of fossil fuels. We are digging up organic material that took millions of years to form, and burning it to provide energy for us.

**The Water Cycle:**

The water cycle is how water moves through all the various areas of the Earth. The water cycle consists for five main components: evaporation, condensation, precipitation, transpiration, and runoff. Because of the water cycle, it is true that the water we have today has been around for a very long time. It simply continues to get cycled through earth’s atmosphere and bodies of water.