



Substances, Compounds & Mixtures

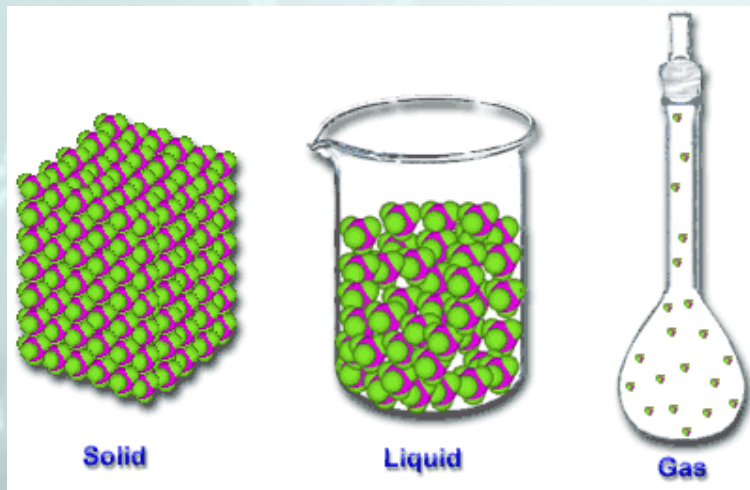
*How everything
is put together.*

Substances



- Matter that has the same composition and properties throughout is called a **substance**.
- ⑩ When different elements combine, other substances are formed.

Substances



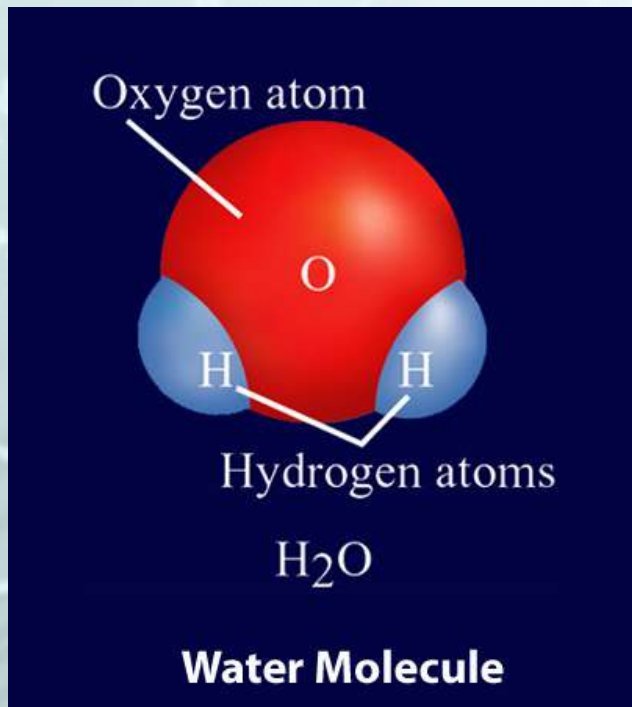
Picture from <http://www.ilpi.com/msds/ref/gifs/statesofmatter.gif>

- Contains only one particle
- Can exist in 3 states of matter
- Can be elements or compounds

Elements

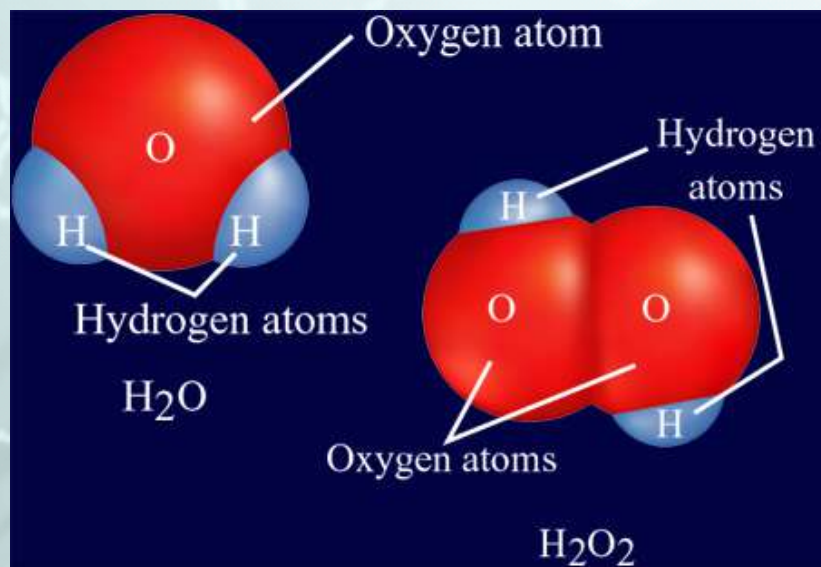
- All substances are built from atoms. If all the atoms in a substance have the same identity, that substance is an **element**

Compounds



- A **compound** is a substance whose smallest unit is made up of atoms of more than one element bonded together.
- ⑩ Compounds often have properties that are different from the elements that make them up.
- ⑩ Examples: Water, salt, sugar

Compounds Have Formulas



- H₂O is the chemical formula for water, and H₂O₂ is the formula for hydrogen peroxide.
- The formula tells you which elements make up a compound as well as how many atoms of each element are present.

Compound Review

- A *pure compound* has the same elements and the same amount of elements all of the time
- Elements are chemically combined
- Compound properties are different from the properties of the elements
- They cannot be separated physically
- Physical properties such as boiling point or melting point of pure substances are do not change

Mixtures



- A **mixture** is a combination of two or more substances where there is **no** chemical combination or reaction.

Mixtures combine physically in no specific proportions. They just mix.



Solids, liquids and gases can be combined to create a mixture.



Mixture Types

- **MIXTURES MAY BE
HOMOGENEOUS OR
HETEROGENEOUS**

Homogeneous Mixtures

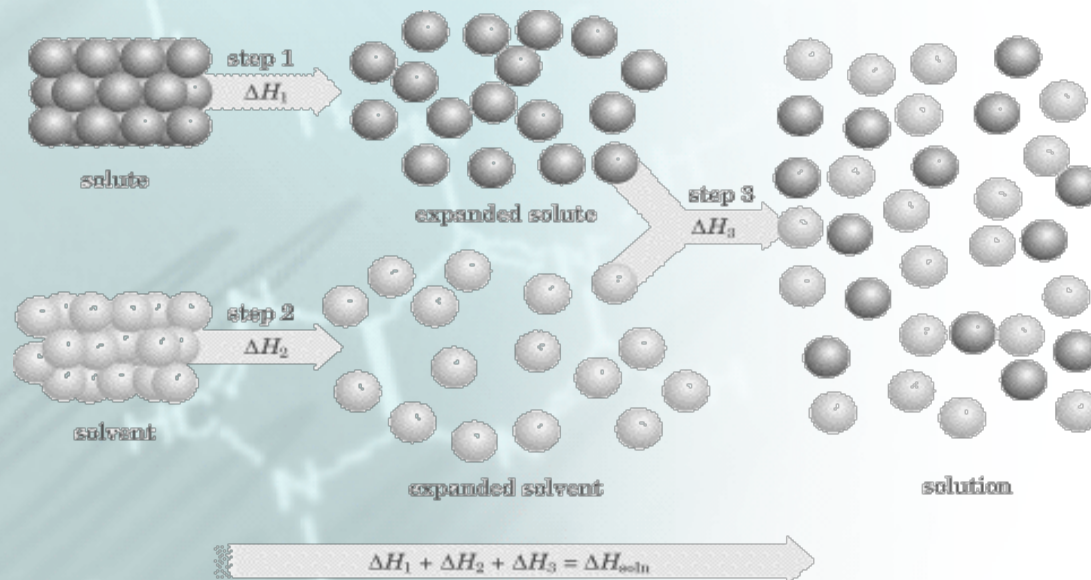
- **Homogeneous Mixtures:**
- The prefix: "homo"- indicates the same
- Have the same uniform appearance and composition throughout



Solutions

- **SOLUTIONS**

are homogeneous mixtures



What is a solution?

- A **solution** is a mixture of two or more substances.
- At least two substances must be mixed in order to have a solution



A solution has two parts

- The substance in the smallest amount and the one that **DISSOLVES** is called the **SOLUTE**
- The substance in the larger amount is called the **SOLVENT** - it does the dissolving
- IN most common instances water is the solvent



Examples of solutions

- Salt water
- Clean Air
- Vinegar

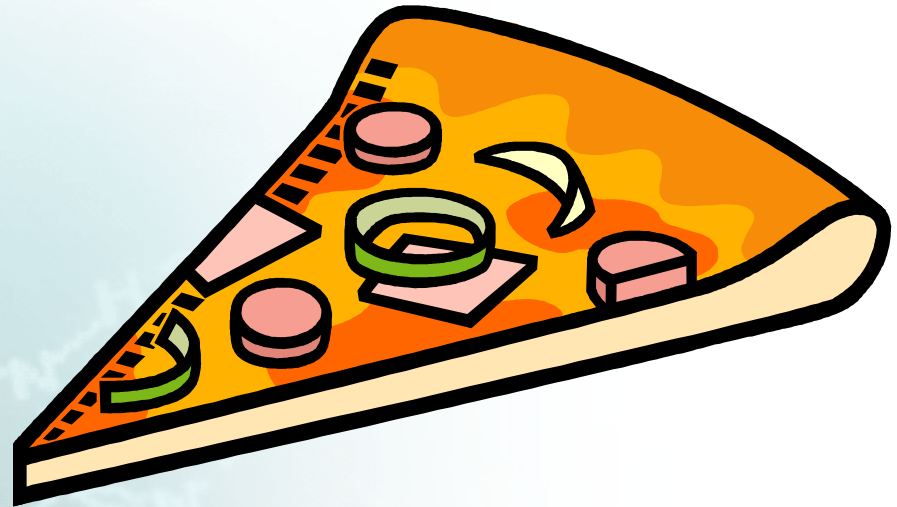


Heterogeneous Mixtures:

- The prefix: "hetero"- indicates difference
- A **heterogeneous mixture** consists of visibly different substances or phases
- Two or more parts can be seen

Examples:

- Pizza
- Sandwich
- Chex Mix



Suspensions

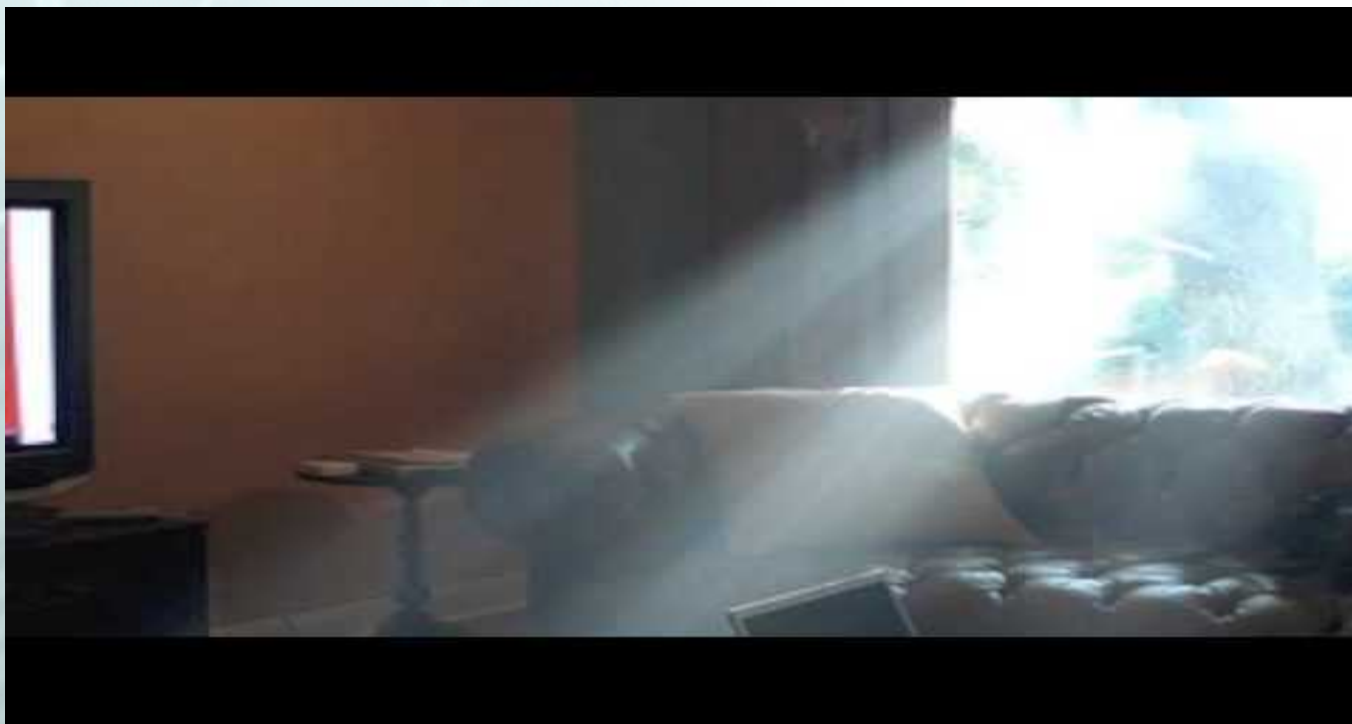


- A **SUSPENSION** is a heterogeneous mixture of large particles
- These particles are visible and will settle out on standing
- Examples of suspensions are: fine sand or silt in water or Italian salad dressing

Colloids

- A **colloid** is a type of mixture with particles that are larger than those in solutions but not heavy enough to settle out.
 - Examples include: Paint (liquid with suspended colloid particles) and Fog (particles of liquid suspended in air)
- Colloids are detected with the **Tyndall Effect** which is the scattering of light by colloidal particles

Tyndall Effect



Compounds vs Mixtures

Compounds

**Combine chemically
forming molecules**

Combine in set proportions

Separated chemically

Mixtures

**Not chemically
combined**

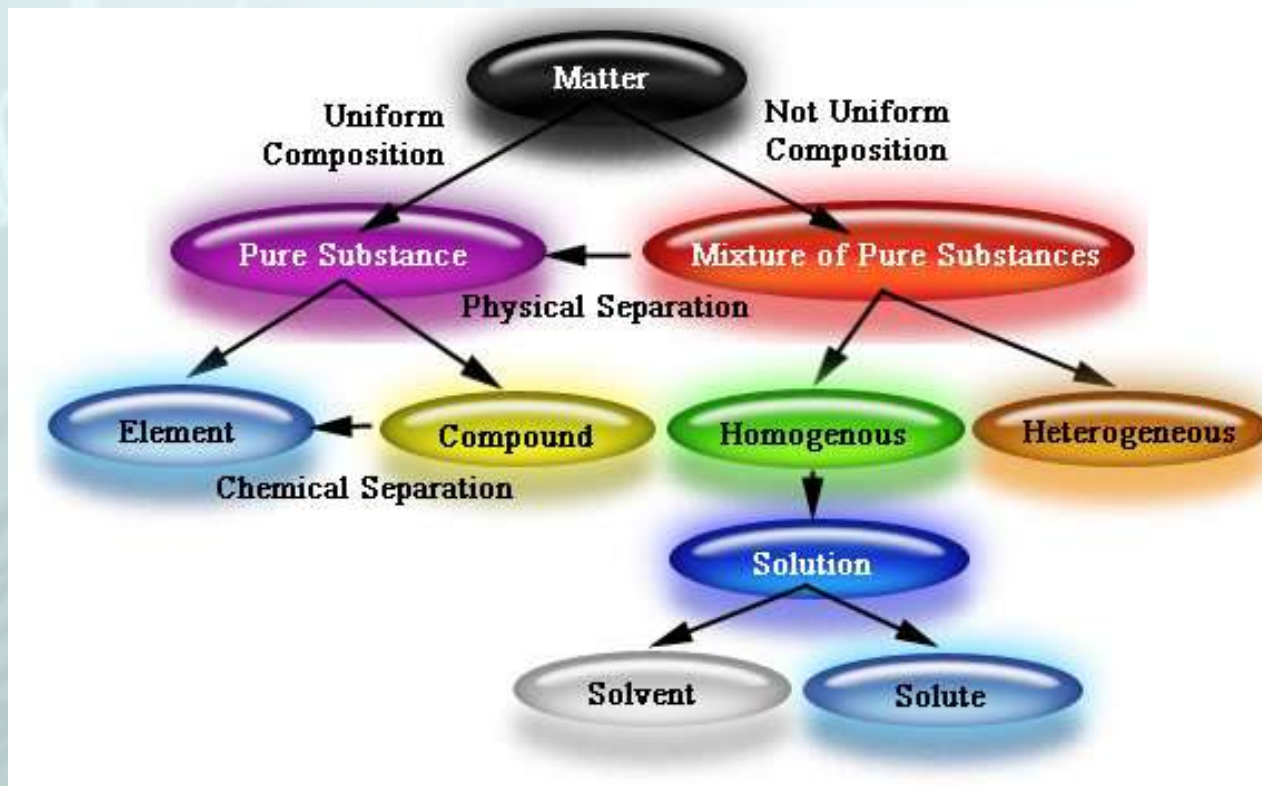
**Can combine in any
proportion**

Separated physically

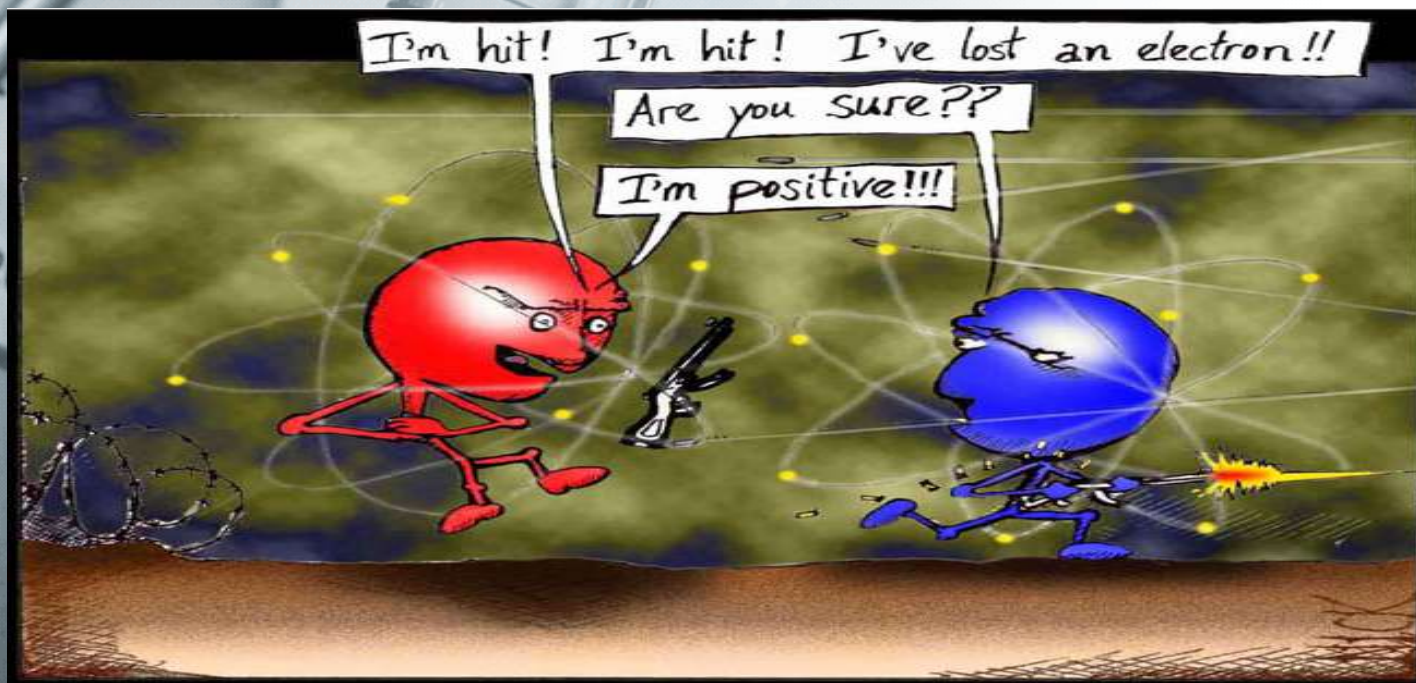
Review!

- Draw a concept map of what we have learned about Matter! In other words, map out the differences between substances and mixtures!

Concept Map



Properties of Matter



Another casualty in the War of the Atoms.

Physical Properties

- A **Physical Property** is a characteristic that can be observed or measured without changing the samples composition
 - Can describe matter and substances

Examples: Density, Color, Odor, Taste, Hardness, Melting Point, Boiling Point

Physical Properties

What properties do elements have?

Elements are generally divided into two main groups — metals and nonmetals. Both groups have a number of subgroups. All elements have certain properties. For example, most metals are hard, shiny solids. They are good conductors of both heat and electricity. Metals are also malleable and ductile.

Element Name	Density	Flame Color	Melting Point	Boiling Point
Antimony	medium	green	medium	high
Barium	medium	yellow-green	high	high
Calcium	low	red	high	medium
Cesium	low	violet	low	low
Molybdenum	high	yellow-green	high	high
Sodium	low	yellow	low	low
Tellurium	medium	green	medium	low
Zinc	high	green	medium	low



Density



Flame Color



Melting Point



Boiling Point



Video

1

2

3

4

5

6

7

8

Physical Properties

- Physical Properties can be broken down into 2 different types:
 - **Extensive Properties** depend on the amount of substance present. (Ex. Mass, Length, Volume)

Intensive Properties do not depend on the amount of substance present. (Density is the same no matter how much of a substance is present)

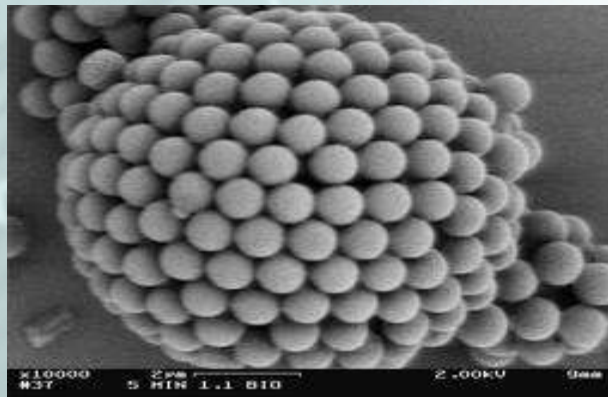
Physical Change

- A **physical change** is a change in size, shape or state of matter
- A state of matter is whether the matter is a solid, liquid or a gas

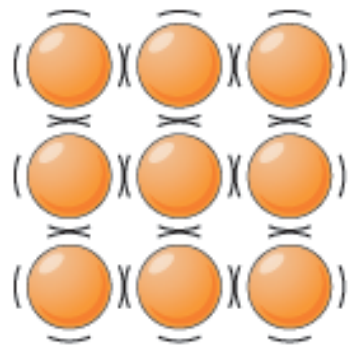


States of Matter

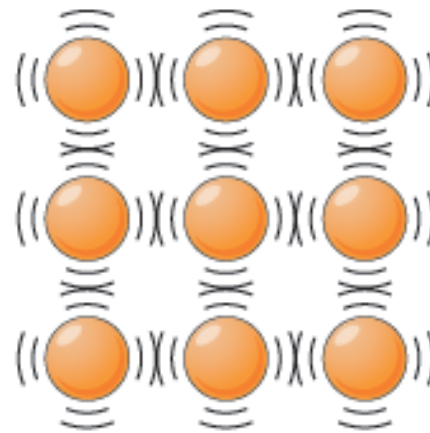
- **Solids** – a form of matter that has its own definite shape and volume
- The particles of a solid are packed tightly together and when heated they expand



Hot vs. Cold Particles in a Solid



Cold

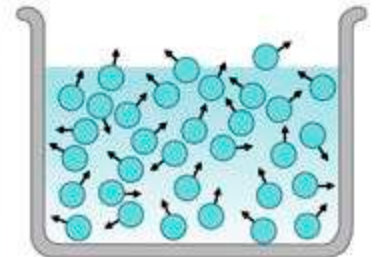


Hot

States of Matter

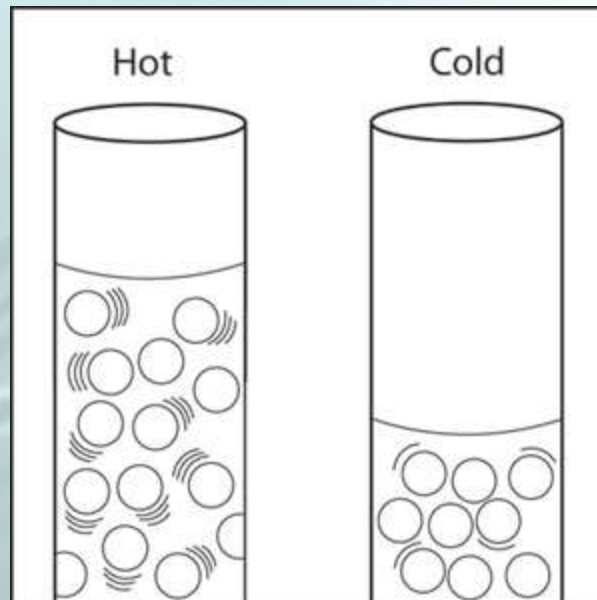
- **Liquids** are a form of matter that flows, has constant volume and takes the shape of its container
 - The particles in a liquid are not held rigidly together and are less closely packed than solids

Do the particles in a liquid act the same in cold temperatures as they do in hot temperatures?



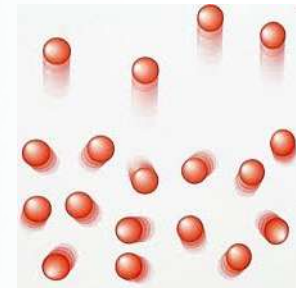
Hot vs. Cold Particles

- **NO!!!!!! Why?**



States of Matter

- A **gas** is a form of matter that flows to conform to the shape of its container and fills the entire volume of its container
- The particles of gas are very far apart compared to liquids and solids
 - Gases can be compressed
- **Vapor** is the gaseous state of a substance that is solid or liquid at room temperature



Hot vs. Cold Particles in a Gas



The gas particles on the right have more kinetic energy than those on the left. So, the gas on the right is at a higher temperature.



Separating Mixtures

- Because mixtures do not create new substances and their properties remain the same...mixtures CAN be separated using their physical properties!
- Can you name some ways to separate mixtures?

Chemical Properties

- Another property of matter are its chemical properties
- **Chemical Properties** are the ability of a substance to combine with or change into one or more substances

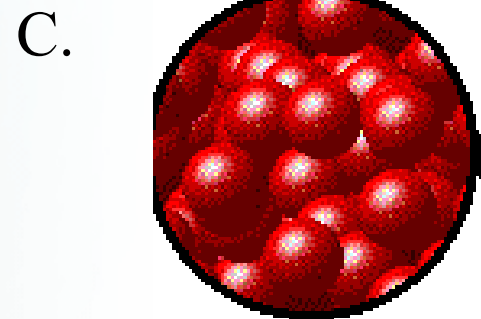
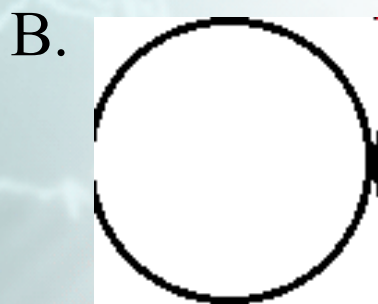
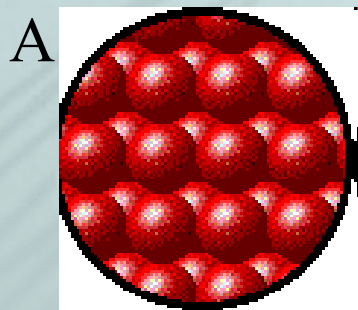


Check!

1. Classify the 3 following events as physical or chemical properties.

- A. Water and oil not mixing together
- B. A screwdriver rusting due to being outside
- C. Vinegar and Baking soda reacting to make a “volcano”

2. Which of the following pictures shows a solid, which a liquid, which a gas?



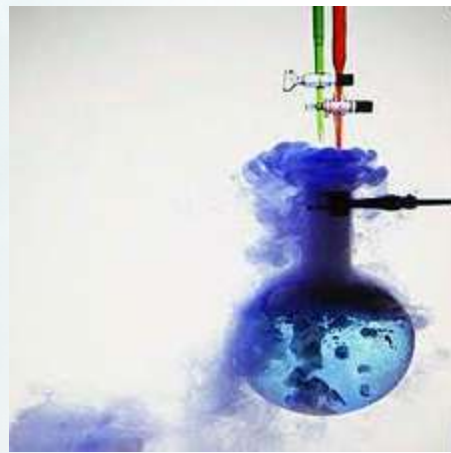
Chemical Changes

- A process that involves one or more substances changing into new substances is a chemical change or chemical reaction
 - Substances formed in the reaction have different compositions and different properties than the substances



Evidence of Chemical Changes (Reactions)

- Heat, Gas or Light is always produced in chemical changes!



Physical and Chemical Changes

- <https://www.youtube.com/watch?v=X328AWaJXvI>

Weathering

- Weathering is the term that describes all the processes that break down rocks in the environment near the earth's surface.
- So, are these processes physical or chemical?
 - BOTH!!!

Law of Conservation of Mass

- Mass is neither created nor destroyed during a chemical reaction
 - Mass of reactants = Mass of Products
- Discovered in the 1700s by Antoine Lavoisier

Check!

- Identify the following as physical or chemical changes

- 1. Liquid Nitrogen is released on the floor of the classroom, it quickly evaporates and is suddenly gone.

- 2. A firework is lit and quickly launches into the air and then explodes into a beautiful red circle.

- 3. You take a breath of fresh air (Mostly Oxygen and Nitrogen) and exhale Carbon Dioxide

- 4. You are having a glass of iced tea on a hot summer day, you suddenly notice your glass is “sweating” and is covered with tiny drops of water outside the glass