

MATTER AND ENERGY

Matter
Anything that takes up space and has mass.
It's what the world is made of



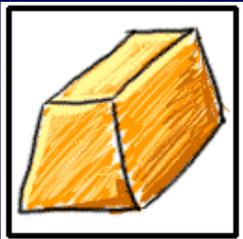
What do you know about matter?
There are several phases of matter.



Solids Liquids Gasses Plasma

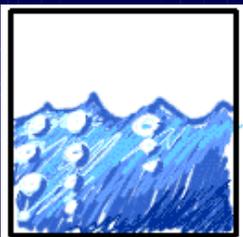
Solids

- Solids hold their own shape.
- Solids have mass.
- *Solids have a definite volume and definite shape.*
- Particles are packed tightly together and have very little energy – *low entropy*



Liquids

- *Takes on the volume of the container.*
- *Definite volume, no definite shape.*
- Liquids have mass.
- Liquids have volume.
- Particles are loosely packed and have medium entropy



Gasses

- Gasses spread out to fill the entire space given.
- *No definite volume and no definite shape.*
- Particles move freely and have a lot of entropy.

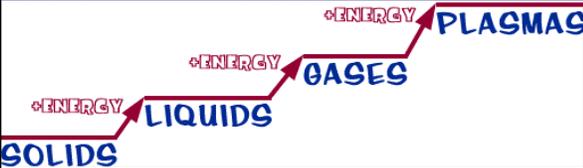


Plasma

- Lightning is a plasma.
- Stars are examples of plasma.
- Plasma is a lot like a gas, but the particles are electrically charged or ionized.
- Particles have extremely high entropy.



Energy determines the state!



Adding or subtracting energy to the system changes the phase.

Energy

- Energy comes in many forms. To name a few:
 - Kinetic
 - Potential
 - Electromagnetic
 - Thermal

First Law of Thermodynamics - in all physical and chemical changes, energy is neither created nor destroyed, but it may be converted to one form or another.

Enthalpy

Measure of the amount of energy in a system.

Measured in joules and usually recorded as a change in enthalpy, ΔH

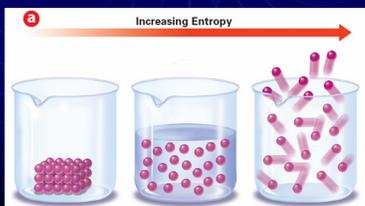
Exothermic – releases energy.

Endothermic – absorbs energy.

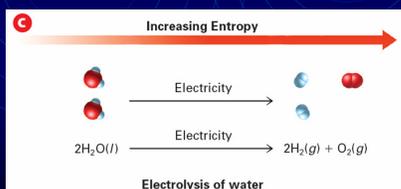
Entropy

- Entropy is the measure of the amount of disorder in a system. Aka the kinetic energy in the system.
- Physical and chemical system attain the lowest possible energy.

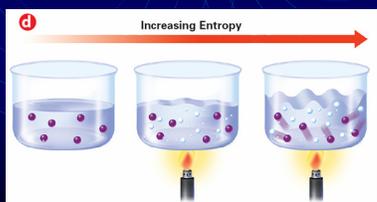
For a given substance, the entropy changes with changes in phase. Solid to gas the entropy increases. Gas to solid the entropy decreases.



Entropy tends to increase in chemical reactions in which the total number of product molecules is greater than the total number of reactant molecules.



Entropy tends to increase when temperature increases. As the temperature increases, the molecules move faster and faster, which increases the disorder.



Heat vs. Temperature

- Objects can be the same temperature but have different amounts of heat energy
- Heat is dependent on MASS.
- Heat is the **transfer of thermal energy**. Usually from areas of high thermal energy to areas of low thermal energy.
- Temperature is the **MEASUREMENT** of the kinetic energy of the particles.

Physical or Chemical Property?

These can be used to identify substances.

Matter has observable and measurable qualities we refer to as **properties**. They are classified into 2 groups, physical properties and chemical properties.

Physical properties are characteristics which can be observed without altering the identity of the substance. Examples of physical properties are:

- Volume and mass from which we can determine density. Density is the mass per unit of volume.
 $D = m/v$.
- Malleability: ability to be hammered into a thin sheet.
- Ductility: ability to be stretched into a wire.

Physical properties cont'd

- Boiling point: temperature at which a substance changes from a liquid to a gas at a given pressure.
- Melting point: the temperature at which a substance changes from a solid to a liquid at a given pressure.
- Hardness
- Luster
- Texture
- Taste
- Color
- Viscosity: ability of a fluid to resist flowing.
- Solubility
- Conductivity : ability to conduct heat, electricity, or sound.

Chemical Property

Chemical properties are characteristics which cannot be observed without altering the identity of the substance.

- Flammability
- Tendency to corrode, react with oxygen and become oxidized.
- Reactivity
- pH
- Solubility

What is a Physical Change?

- A **physical** change alters the form of a substance, but does not change it to another substance.

Example:
Making Orange Juice



What is a Chemical Change?

- When a substance undergoes a **chemical** change, it is changed into a different substance with different properties.

Example:
Baking a Cake



5 Signs of a Chemical Change

1. Color Change
2. Precipitation



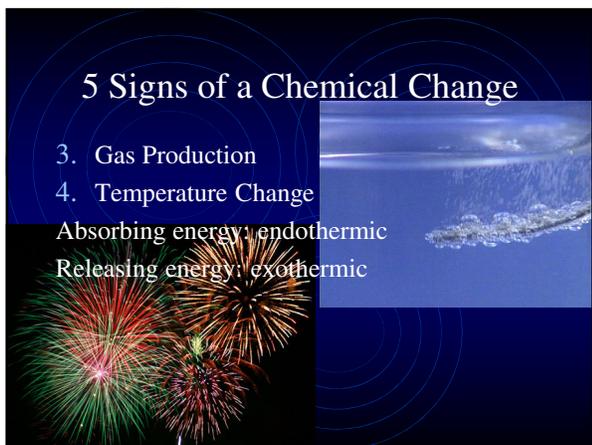
Precipitation

- **Precipitation** – the solid that forms from a solution during a chemical reaction.
- It looks like a cloudy solid in an otherwise clear solution.

5 Signs of a Chemical Change

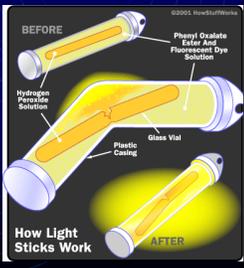
3. Gas Production
4. Temperature Change

Absorbing energy: endothermic
Releasing energy: exothermic



5 Signs of a Chemical Change

5. Changes in Characteristic Properties (odor, light given off)



Qualitative vs. Quantitative

Observations of matter and its properties/changes fall into 2 categories.

1. Qualitative observations: "big picture", using your 5 senses. Color, phase, odor, texture.
2. Quantitative observations: Measurable. mass, volume, density, temperature.

Changes in Matter

- Law of Conservation of Matter/mass
 - Matter in a closed system is neither created nor destroyed. It is simply rearranged.
 - Mass of reactants = mass of products.
