

Matter & Energy

CP CHEMISTRY

- Chemistry is the study of the composition of matter and the changes matter can undergo
- But what exactly is **matter**???

Matter is...

- Basically matter is anything that has mass and occupies space.
- Examples: trees, water, buildings, air
- In short, **EVERYTHING** around you is made of matter!

Properties of Matter

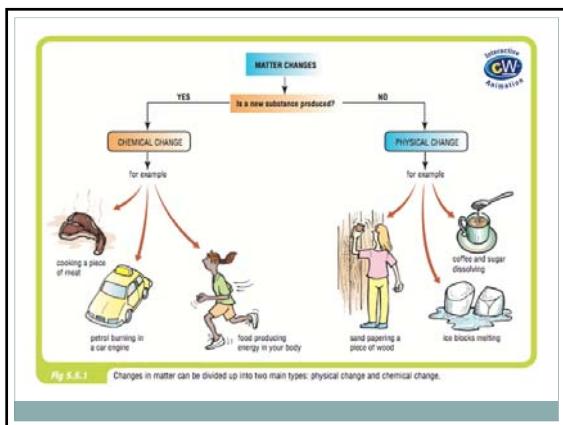
- Properties are characteristics used to describe an object.
- **Physical Property**
 - A condition of a substance that can be observed or measured without changing the substance's composition.
 - Ex: color, luster, hardness
- A physical change involves the changing of physical properties (such as appearance or state)
 - However, the composition or type of matter does NOT change

Phase Changes

- Phase changes can involve a change in volume, but mass remains constant.
- Adding or removing energy (or heat) from matter results in phase changes
- What are some examples of phase changes?

Properties of Matter

- **Chemical Property**
 - Property that describes how a substance can change into a NEW substance
 - Ex: flammability, reactivity with water/air/oxygen
- During a chemical change, the original substance is changed into a new and different substance
 - What is another name for a chemical change?



Properties of Matter

- How is a chemical change different from a physical change?

PHYSICAL CHANGE OF WATER INTO ICE

CHEMICAL CHANGE OF HYDROGEN PEROXIDE INTO WATER

3 Stages of Matter

3 Stages of Matter

- **Solid**
 - Definite shape and volume
 - Cannot flow or take shape of container
 - Particles are compact and organized
- **Liquid**
 - Constant volume
 - Takes shape of container it's in (flows)
 - Particles are touching but disorganized
- **Gas**
 - Takes shape of container (flows)
 - Expands to fill any volume
 - Particles are far apart and compressible

Is it a Solid, a LIQUID, or a GAS?

Follow the arrows to decide which state of matter your item is.

```

graph TD
    START([START]) --> Q1{Does the item spread out to fill its container?}
    Q1 -- No --> Solid[Your item is a Solid.]
    Q1 -- Yes --> Gas[Your item is a gas.]
    Gas --> Q2{Does the item take the shape of its container?}
    Q2 -- No --> Solid
    Q2 -- Yes --> Liquid[Your item is a liquid.]
  
```

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Classification of Matter

- A **mixture** is a combination (physical blend) of two or more substances.
 - Can be separated physically (by hand, filtration, etc.)
- Matter that can NOT be separated physically is called a **pure substance**.
 - Can only be separated by breaking bonds between elements (chemical process)

Classifying Pure Substances

- **Elements**
 - Simplest kind of matter
 - All one kind of atom
- **Compound**
 - Substance that can only be broken down by chemical means
 - Made of two or more atoms chemically combined (not just physically blended!)
 - When broken down, the pieces have completely different properties than the original compound





Classifying Mixtures

- A mixture is a physical blend of at least 2 substances.
 - Can have a different compositions
- Heterogeneous
 - The mixture is NOT uniform in composition
- Homogeneous
 - Same composition throughout (looks uniform)
 - Also called a **solution**



```

graph TD
    Matter((Matter)) --> Solids{Can it be shaped or deformed?}
    Solids -- YES --> Solids_Star[ ]
    Solids -- NO --> Liquids((Liquids))
    Liquids --> Heterogeneous{Is it Uniform throughout?}
    Heterogeneous -- YES --> Heterogeneous_Star[ ]
    Heterogeneous -- NO --> Homogeneous{Is it Uniform throughout?}
    Homogeneous -- YES --> Homogeneous_Star[ ]
    Homogeneous -- NO --> Elements{Can it be broken down?}
    Elements -- YES --> Elements_Star[ ]
    Elements -- NO --> Compounds{Can it be broken down?}
    Compounds -- YES --> Compounds_Star[ ]
    Compounds -- NO --> Mixtures{Can it be separated by physical means?}
    Mixtures -- YES --> Mixtures_Star[ ]
    Mixtures -- NO --> PureElements((Pure Elements))
    PureElements --> Penny(( ))
    Mixtures --> Salt(( ))
    Mixtures --> Cheetos(( ))
    Mixtures --> Beans(( ))
    Mixtures --> CannedFood(( ))
    Mixtures --> Milk(( ))
    Mixtures --> Gatorade(( ))
  
```

How can we classify matter?

The flowchart classifies matter into four main states:

- Solids**: Can it be shaped or deformed? (YES) → Star icon.
- Liquids**: Can it be shaped or deformed? (NO) → Liquids box.
- Gases**: Can it be broken down? (YES) → Star icon.
- Pure Elements**: Can it be broken down? (NO) → Elements box.

The Liquids state leads to **Heterogeneous** (Is it Uniform throughout? NO) → Star icon and **Homogeneous** (Is it Uniform throughout? YES) → Star icon.

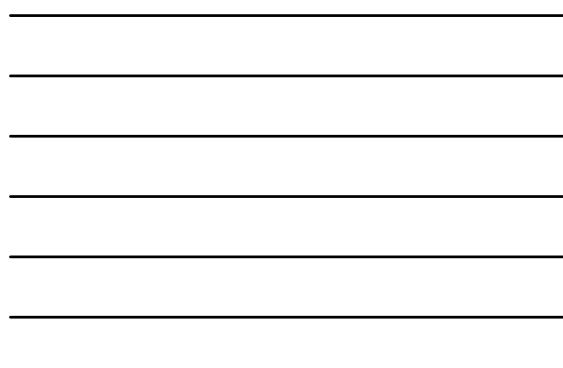
The Gases state leads to **Mixtures** (Can it be separated by physical means? YES) → Star icon and **Pure Compounds** (Can it be separated by physical means? NO).

The Pure Elements state leads to **Penny**.

The Elements box leads to **Cheese**.

The Compounds box leads to **Salt**.

The Mixtures state leads to **Cheetos**, **Beans**, **CannedFood**, **Milk**, and **Gatorade**.



The Periodic Table

- Elements are represented by a one or two letter **symbol**.
- Compounds are represented by a **formula**.
- The first letter in a symbol is always capitalized
 - If there is a second letter it is lowercase (ie: He, Li, Cr)
- Columns = Groups or Families
- Rows = Periods

Classifying Elements

- Elements can be classified as:
 - Metals
 - ✗ Located to the left of the "zigzag" line
 - Nonmetals
 - ✗ Located to the right of the "zigzag" line
 - Metalloids
 - ✗ Located directly above or below the "zigzag" line

