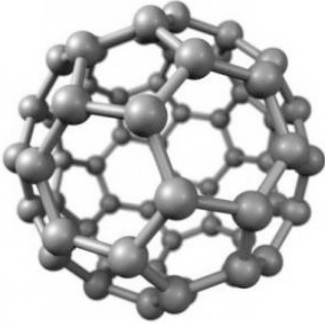


## What is Matter?

Mixtures vs. Pure Substances  
Physical vs. Chemical Properties  
Physical vs. Chemical Changes

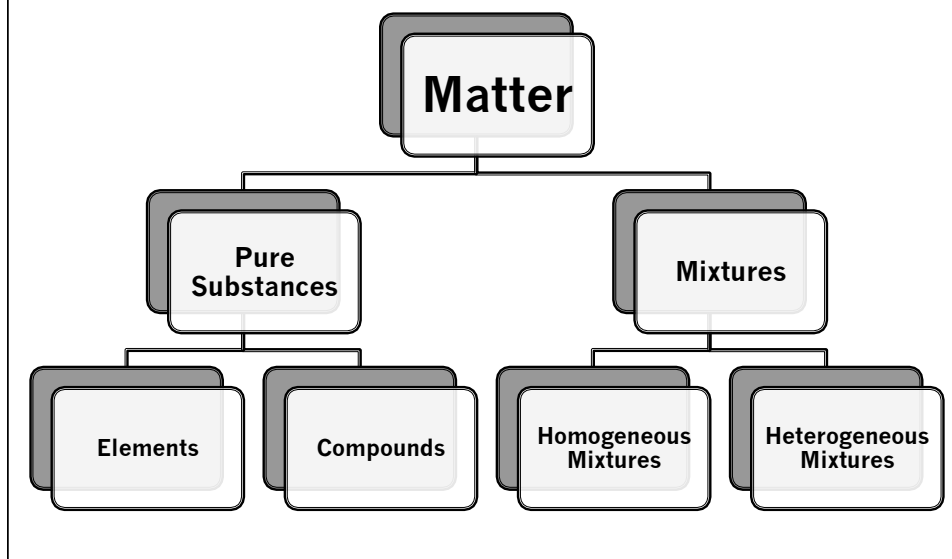
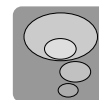
*CP Chemistry notes  
Monday, Sept. 14<sup>th</sup>, 2009*



## What is Matter?

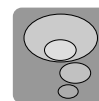
- **Matter** is anything that has mass and takes up space
  - anything you can touch and feel
  - **mass** is simply a measurement of the quantity of matter – **how much** there is
    - it's not the same as weight – it's independent of gravity
  - "**space**" is just a measurement of volume
  - all matter is made of tiny, tiny particles
  - typically separated into these classifications:
    - **pure substances**: elements & compounds
    - **mixtures**: homogeneous & heterogeneous
- *Energy is NOT made of matter!*

## Matter: Classifications of Matter



## Pure Substances

forms of matter with definite or constant composition



### Elements

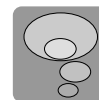
- simplest form of matter
- only made of one kind of atom
- cannot be separated into simpler substances
- everything listed on the periodic table is an element!
  - 83 naturally occurring, 117 total
  - some created by scientists, most recently in 2002

### Examples of elements

- helium [He]
- carbon [C]
- neon [Ne]
- sodium [Na]
- aluminum [Al]
- sulfur [S]
- iron [Fe]
- gold [Au]
- ...etc!

## Pure Substances - continued

forms of matter with definite or constant composition



### Compounds

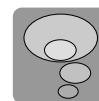
- chemical combination of two or more kinds of atom
- cannot be separated into simpler substances by physical changes
- CAN be separated by chemical changes
  - separation results in new substances with different properties
  - permanent change
- combined by chemical bonds
  - molecules & ionic compounds

### Examples of Compounds

- distilled water [ $\text{H}_2\text{O}$ ]
- oxygen gas [ $\text{O}_2$ ]
- table salt [ $\text{NaCl}$ ]
- sugar (sucrose) [ $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ ]
- iron oxide (rust) [ $\text{Fe}_3\text{O}_4$ ]
- sulfuric acid [ $\text{H}_2\text{SO}_4$ ]
- sodium hydroxide (lye) [ $\text{NaOH}$ ]
- *...and many, many more!*

## Mixtures

physical blends of two or more substances in which the substances retain their identity



### Homogeneous Mixtures

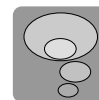
- consistent composition throughout
- can be separated through chemical and physical changes
  - more difficult to separate through physical changes
  - some separation processes are distillation, freezing, coagulation, chromatography
- homogeneous mixtures in water are called **solutions**
  - solute is dissolved in solvent

### Examples

- sugar dissolved in water
- salt dissolved in water
- just about any beverage except for distilled water, including carbonated beverages
- homogenized milk
- brass
- steel
- many plastics
- *...and many, many more!*

## Mixtures - continued

physical blends of two or more substances in which the substances retain their identity



### Heterogeneous Mixtures

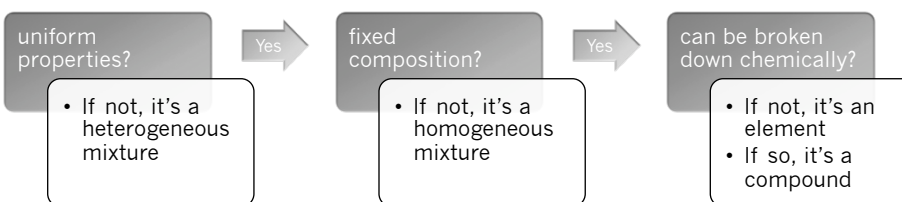
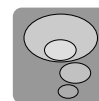
- inconsistent composition throughout
  - NOT evenly blended
- relatively easy to separate, especially through physical changes
  - filtration, sifting, magnetism, dissolving
- types of heterogeneous mixtures:
  - suspensions – particles will settle out
  - colloids – particles will NOT settle out

### Examples

- air
- almost all food!
  - salad, cereal, trail mix, etc.
- blood
- soil/dirt
- cement
- wood
- granite
- ...and many, many, more!

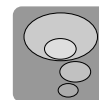
## Classification flow chart

follow the arrows to classify a sample of matter



## Physical vs. Chemical Properties

used to describe matter



### Physical Properties

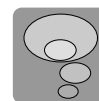
- can be observed without changing the substance
- changes in physical properties can be the result of physical change (can be reversed) or chemical change (CANNOT be reversed)
- examples are:
  - size, shape, mass/weight, color, texture, density, melting/freezing point, boiling point, pressure (for gases)

### Chemical Properties

- can only be observed through a permanent chemical change in the substance
- used to predict chemical changes and classify substances
- elements in the same column (group) on the periodic table have similar chemical properties
- elements become less metallic and more nonmetallic as you go from left to right on the periodic table

## Physical vs. Chemical Changes

remember, chemistry is the study of matter and the changes it undergoes!



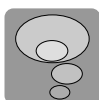
### Physical Change

- change in one or more physical properties of a substance
  - can be reversed - NOT permanent
  - same substance - does NOT change the chemical composition
- examples are:
  - folding, compressing/expanding, cutting, dissolving, changes of state (boiling, melting, freezing, etc.)

### Chemical Change

- change in one or more chemical properties of a substance
  - CANNOT be reversed without another chemical change – permanent!
  - new substance is formed, usually with some new physical properties as well
  - Law of Conservation of Matter must ALWAYS be satisfied: “Matter cannot be created or destroyed, only changed”
- examples: burning, rusting, decomposition, digestion

## Homework



- Read Chapter 2.1-2.4, 3.4
- do these book problems:
  - p.31 #1, 2, 4
  - p.35 #7-12
  - p.40 #14-18
  - p.47 #24-28
  - p.72 #25-28
  - p.31 #3
  - p.43 #19-20
  - p.47-48 #29, 34-35, 43, 46
- do **Physical & Chemical Changes WS**