

Ch. 2 Notes – MATTER – PROPERTIES AND CHANGES

NOTE: Vocabulary terms are in **boldface and underlined**. Supporting details are in *italics*.

I. Properties of Matter

A. pure substance vs. mixture

- 1) **pure substance**—*matter with the same definite composition and properties*
- 2) Pure substances can be elements or compounds.

a) **elements**

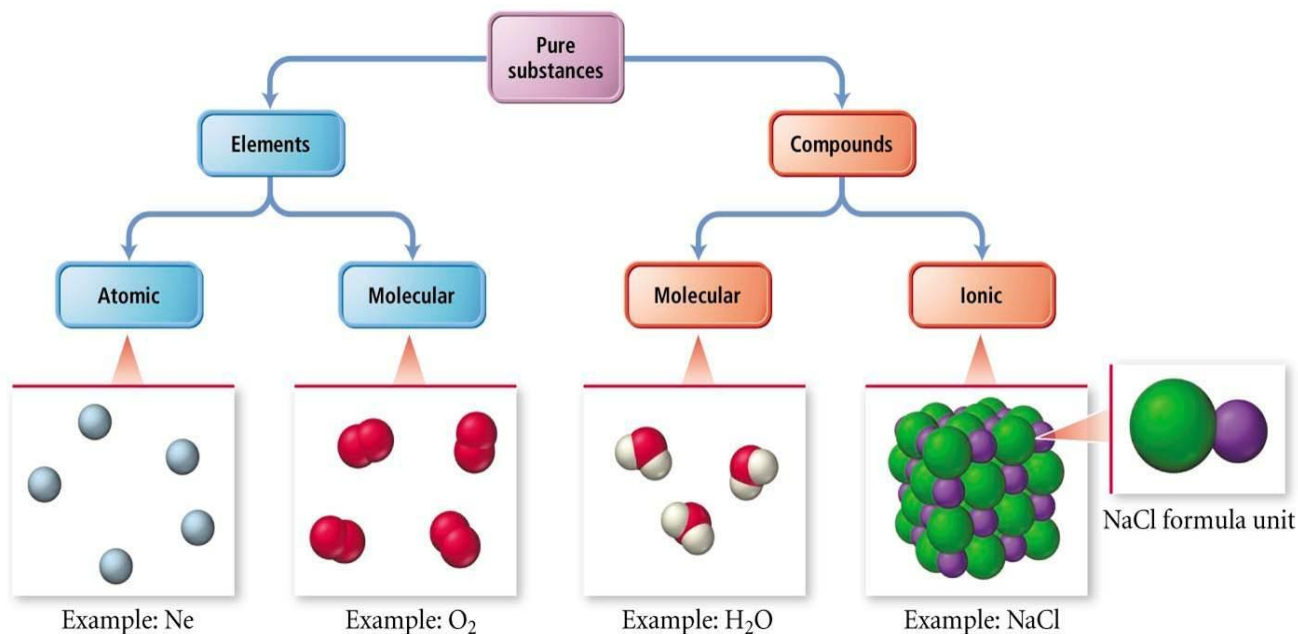
- 1) *simplest form of matter retaining the properties of that matter*
- 2) examples : Ag Pb O W
- 3) chemical symbols
 - each element has a different symbol
 - capitalize the first letter only
 - word roots from English and other languages (Latin)
- 4) organizing the elements: **periodic table** of the elements

One of the main goals of this class is to “decode” the periodic table and learn how to derive information from it.

b) **compounds**

- more than one element in a type of matter*
- can only be separated by chemical methods*
- iii. examples: NaHCO₃ CO H₂CO CaCO₃
- iv. **formula**—*correct combination of chemical symbols*

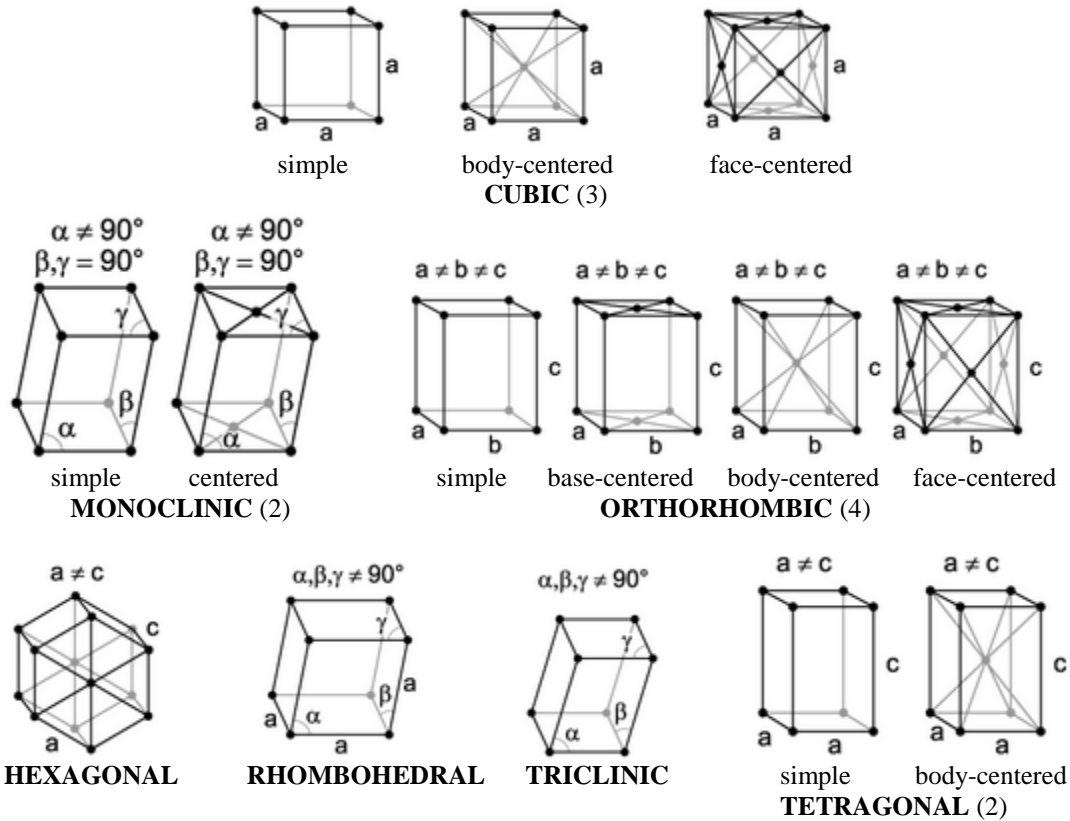
Classification of Elements and Compounds



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B. states of matter (more information later in the course)

1) **solid**—form of matter with *fixed shape and volume* (can be crystalline or amorphous)



2) **liquid**—form of matter with *variable shape and fixed volume*

3) **gas**—form of matter with *variable shape and volume*

(**vapor** – if a substance is *not commonly found as a gas* at room temperature, and it is found as a gas, it is called a vapor)

4) **plasma**—*low-density ionized gases* (found in lightning, plasma TVs, stars)

II. Changes in Matter

A. physical changes and properties

1) **physical change** (*physical ACTION*)

- alterations that do not change the substance's identity and composition*
- e.g.: paper that is shredded is still paper; sugar dissolved in water is still sugar
- *** key words: boil, freeze, melt, condense, dissolve, crush, break, cut...

2) **physical property** – *physical CHARACTERISTIC that can be observed and measured without changing the chemical composition of the substance*

conductivity	melting point	malleability
density	ductility	odor
solubility	boiling point	refractive index

- intensive property**—does not depend on the amount of matter
- extensive property**—depends on the amount of matter

B. chemical changes and properties

1) **chemical change** (*chemical ACTION*)—alterations that changes substance’s identity and composition to something new, through a **chemical reaction**

a) e.g.: burning firewood, rotting of fruit

b) *** key words: rust, decompose, corrode, burn, ferment, grow, decay...

2) **chemical property**— chemical CHARACTERISTIC; ability to form new substance as a result of chemical reactions (rxns.)

radioactivity	explosivity	flammability
heat of combustion	causticity	corrosivity
chemical stability	pH	

3) **chemical reactions**—the changing of substance(s) into new ones

a) *reactants*—starting substances in a rxn.

b) *products*—new substances formed in a rxn.

(“Reactants react to produce the products.”) $\text{H}_2\text{SO}_4 + 2\text{NaOH} \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$

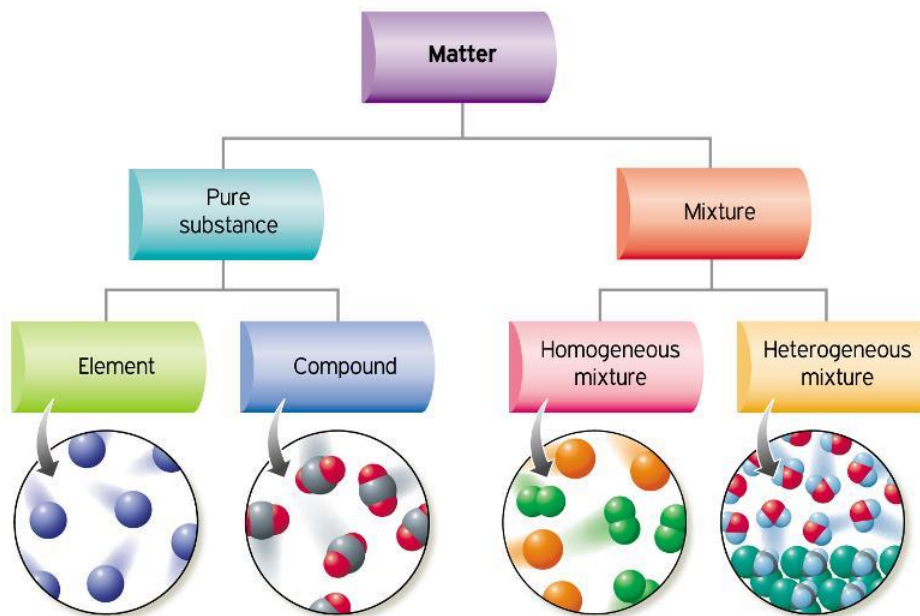
c) *** clues that a chemical rxn. has occurred

energy is given off (gets hotter)	color change	production of a gas
energy is absorbed (gets colder)	odor change	usually not easily reversible
production of a solid (precipitate; ppt.)		

III. Mixtures of Matter

A. **mixture**—physical blend of two or more substances

(gas-gas, liquid-gas, gas-liquid, liquid-liquid, solid-liquid, solid-solid)



(source: element97)

B. mixtures can be *heterogeneous* or *homogeneous*

1) phase—area of uniform composition and properties

2) *heterogeneous*

a) *not uniform*; has different “phases”

b) examples: granite, Italian salad dressing

3) *homogeneous*

- a) also called a **solution**; *uniform*; has one “phase”
 - b) examples: salt water, air, alloys
 - c) parts of a solution
 - **solute**—*the substance being dissolved*
 - **solvent**—*the substance doing the dissolving*
 - d) **aqueous solutions** (*aq*)—*water containing dissolved materials*
- C. mixtures can be separated by physical means (more information later in the course)
- 1) **filtration**—separation of solid from liquid through a barrier
 - 2) **distillation**—separation of liquids with different boiling points
 - 3) **crystallization**—separation of solid from an unstable solution
 - 4) **sublimation**—conversion of a solid directly to vapor
 - 5) **chromatography**—separation of components due to density differences



- IV. Relevant Laws (more information later in the course)
- A. **Law of Conservation of Mass**—*in a physical or chemical change, matter cannot be created nor destroyed, it merely changes form*
 - 1) reactant mass = product mass
 - 2) exceptions are nuclear rxns.
 - B. **Law of Conservation of Energy**— *in a physical or chemical change, energy cannot be created nor destroyed, it merely changes form*
 - C. **Law of Definite Proportions**—*a compound is composed of the same elements in the same proportion by mass*

$$\text{PERCENT BY MASS} = \frac{\text{MASS OF ELEMENT}}{\text{TOTAL MASS OF COMPOUND}} \times 100$$
 - D. **Law of Multiple Proportions**— when two elements combine with each other to form more than one compound, the masses of one element that combine with a fixed mass of the other are in a ratio of small whole numbers