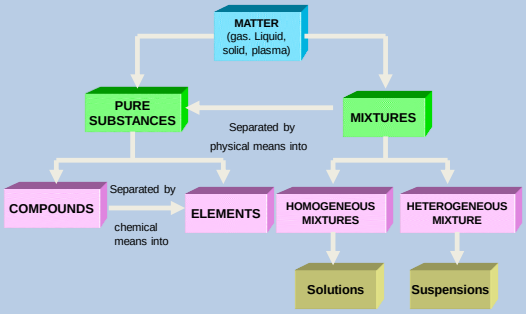
Classification of Matter

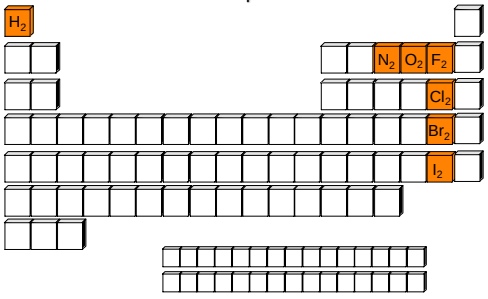


Pure Substances

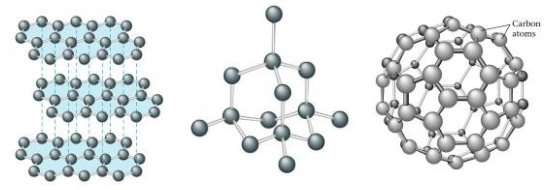
- Element
  - composed of identical atoms
  - Listed on periodic table
  - EX: copper wire (Cu), aluminum foil (Al)

Courtesy Christy Johannesson www.nisd.net/communicationsarts/pages/chem

Diatomic Elements- come in pairs if they are not part of a compound



Allotropes- same element, different connectivity



Zumdahl, Zumdahl, DeCoste, World of Chemistry 2002, page 27

Pure Substances

- Compound
  - composed of 2 or more elements in a fixed ratio
  - properties differ from those of individual elements
  - EX: table salt (NaCl)

http://www.youtube.com/watch?v=2mzDwgyk6QM

Courtesy Christy Johannesson www.nisd.net/communicationsarts/pages/chem

Law of Definite Composition

- A given compound always contains the same, fixed ratio of elements.

Ex. Water is always made of two hydrogen atoms and one oxygen atom.

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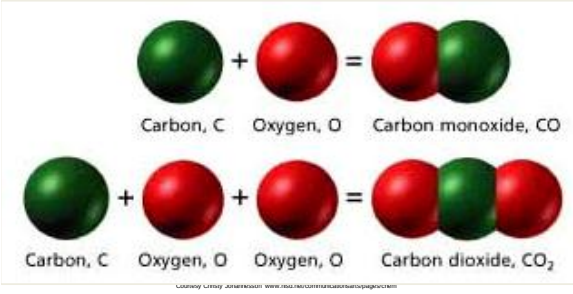
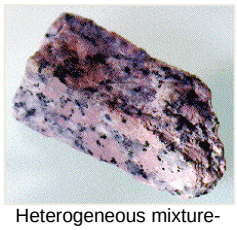
Law of Multiple Proportions

– Elements can combine in different ratios to form different compounds.



Mixtures

Combination of two or more pure substances.



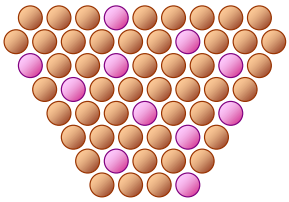
Heterogeneous mixture- not uniform throughout; able to see different components

Homogeneous mixture- uniform throughout; well mixed; not able to see different components

An alloy is a homogeneous mixture of metals.

- Brass = Copper + Zinc

Solid Brass



Copper

Zinc

Solution

– Homogeneous mixture
– Very small particles
– Particles don't settle over time

-EX: rubbing alcohol

Suspension

-heterogeneous mixture
-Particles may be a mix of sizes
-Particles settle over time
Ex. Italian salad dressing

Colloid

– heterogeneous
– medium-sized particles
– Displays Tyndall effect (particles are large enough to scatter light)
– particles don't settle
– EX: milk

Compounds vs. Mixtures

- Compounds have properties that are uniquely different from the elements from which they are made.
  - A formula can always be written for a compound
  - e.g. NaCl → Na + Cl_2

  Sodium is a very reactive metal. Chlorine is a deadly yellow gas. When you put the two together you end up with a white crystalline substance which can be ingested.
- Mixtures retain their individual properties; can be separated by physical means
  - e.g. Salt water is salty and wet; can be separated by distillation

Mixtures can be separated by physical means!

- Magnet
- Filter
- Chromatography
- Centrifuge
- Distillation

Magnets are used to separate magnetic substances from nonmagnetic substances.

Ex. Separating iron filings from sand

Separating iron from aluminum in a recycling plant

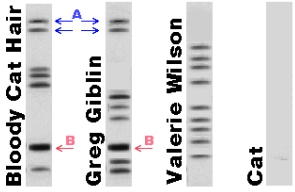
Filtration separates a liquid from a solid

Zumdahl, Zumdahl, DeCoste, World of Chemistry 2002, page 40

Chromatography-

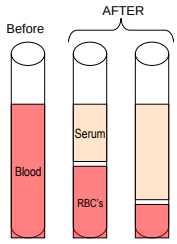
components are separated by size as they move through a medium; small particles move faster and separate more

- Tie-dye t-shirt
- DNA testing (gel electrophoresis)

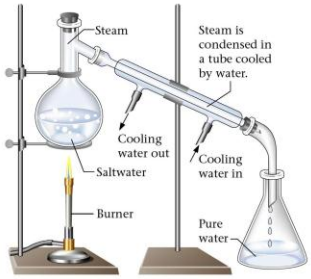


Centrifugation

- Spin sample very rapidly: denser materials go to bottom (outside)
- Ex. Separate blood into serum and plasma
  - Serum (clear)
  - Plasma (contains red blood cells 'RBCs')
    - Check for anemia (lack of iron)



Distillation- the solution is boiled and steam is driven off then condensed back to water



Zumdahl, Zumdahl, DeCoste, World of Chemistry 2002, page 39