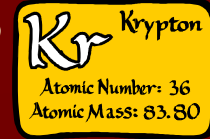


# Classification of Matter

Chemistry 11



## What is an Element?



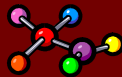
### ■ Element:

- a substance which cannot be separated into a simpler substance as a result of any chemical change
- If broken down further, it no longer has the same properties
- Different elements are classified based on different physical properties



## Atoms, Molecules, and Ions

- **Atom:** smallest particle of an element that retains the chemical identity of the element
  - Made up of protons (+ve), electrons (-ve), and neutrons (neutral)
- **Molecule:** a cluster of 2 or more atoms held together by covalent bonds (sharing of electrons)
  - Ex. O<sub>2</sub>, CO<sub>2</sub>
- **Ion:** an atom or group of atoms that has gained or lost electrons to become positively or negatively charged
  - Ex. Na<sup>+</sup> (Sodium ion), Br<sup>-</sup> (Bromide ion)



## More Definitions:

so you know what I mean when I say...

- **Particle:** a general term to describe a small bit of matter such as an atom, molecule, or ion
- **Phase:** any part of a system which is uniform in both composition and properties
  - Ex. Oil and water don't mix, so you get 2 phases

Has 2 phases

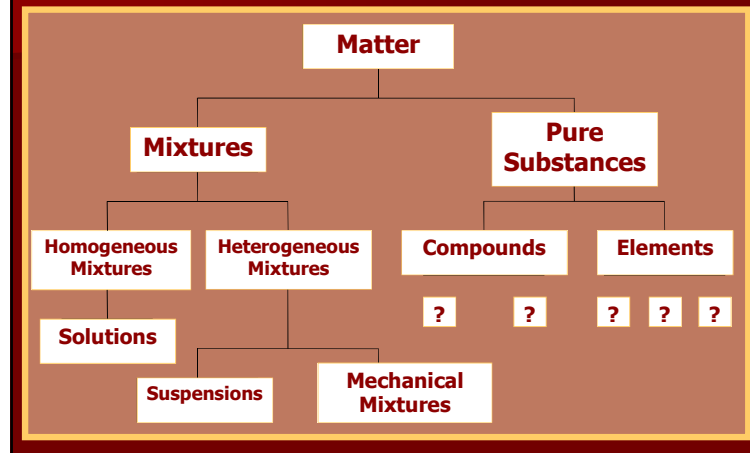


## Properties of Matter:

- Matter is classified based on its properties (characteristics)
- What types of matter are there?
  - Elements
  - Compounds
  - Mixtures

...but it is a little more complicated than that!

## Classification Scheme:



## A. PURE SUBSTANCES

- **Pure Substance:** one type of particle present & constant set of physical properties
  - can be represented with a single chemical formula  
ex. H<sub>2</sub>O
- 1. Element:** simplest form of matter, only has one set of properties
  - can't be decomposed into simpler substances
  - located on the periodic table of ELEMENTS
  - 3 categories: metals, non-metals, metalloids

- **2. Compound:** 2 or more elements joined together by a chemical bond

- can write a unique chemical formula for each compound
- properties of compound are different from properties of its component elements



- Ex. NaCl(white solid, soluble in H<sub>2</sub>O, high m.p.) vs. Na(shiny, explosive in H<sub>2</sub>O) and Cl( poisonous green gas)
- elements present in compound combine in definite proportions by mass ("Law of Definite Composition")
  - water H<sub>2</sub>O = 2 atoms H + 1 atom O  
(11.1% mass) (88.9% mass)

## B. Mixtures

- **Mixture:** a combination of 2 or more kinds of matter that have separate identities
  - components are physically combined (mixed together) and can easily be separated
  - the amounts of each substance can vary, thus varying the properties of the mixture
  - Represented by 2 or more chemical formulas in varying proportions

▪ Ex.  $H_2O + NaCl$

### Two Types:

- I. Heterogeneous
- II. Homogeneous



- **I. Heterogeneous Mixture:** mixture with varying composition and more than one phase present

- each component has its own unique physical properties
- look for a visible differences
- Ex. Salt mixed with pepper, oil and water



1. mechanical mixture: combination of solids which can be distinguished by eye  
ex. salad
2. suspension: combination of solid & liquid or 2 liquids which are mixed but not dissolved
  - if left, will separate into layers by settling  
ex. orange juice, oil & water

- **II. Homogeneous Mixture:** mixture with uniform composition throughout (only one phase present)

- will have its own set of physical properties
  - Ex. Boiling point, density, etc.
- different amounts of the components change the physical properties of a homogeneous mixture

1 L of $H_2O + 50.0$ g of NaCl	1 L of $H_2O + 100.0$ g of NaCl
Colourless	Colourless
Freezing Point: $-1.62^\circ C$	Freezing Point: $-3.29^\circ C$
Density: 1.035 g/mL	Density: 1.087 g/mL

- A solution is an example of a homogeneous mixture...but not all solutions are a solid dissolved in a liquid (just most of the ones we talk about!)

Type of solution	Example
gas in gas	air ( $O_2$ , $N_2$ , etc.)
gas in liquid	soda pop
liquid in liquid	water and alcohol
solid in liquid	salt water
solid in solid	metal alloys

## Solutions:

- There are two components to a solution

- **Solute:** the component which exists in smaller quantity
- **Solvent:** the component which exists in larger quantity

- **NOTE:** When water is in the solution, it is **always** called the solvent...it is the **universal solvent**...



...and the solution is called an **aqueous solution**

- Ex.  $\text{NaCl}_{(\text{aq})}$

