

Unit 0 - Introduction to Chemistry

Part 1: Basics of Chemistry

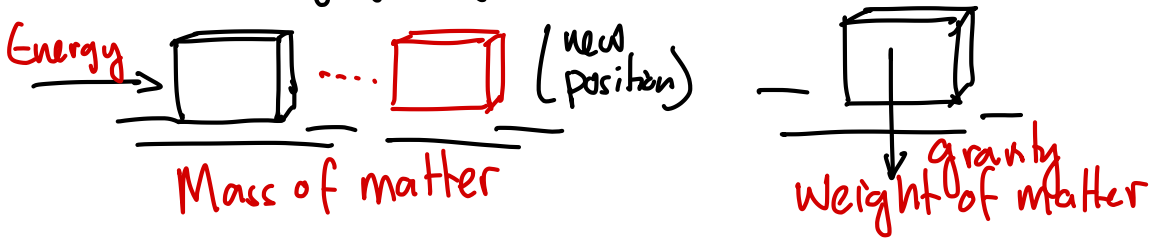
Core Definitions of Chemistry

Chemistry is the study of matter and how matter changes

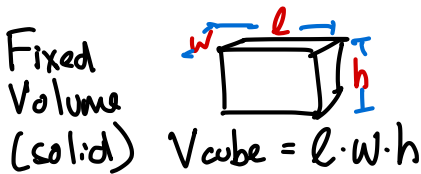
Matter is any object that has mass and takes up space

Mass is a property of all matter based on the amount of energy required to move (change position) of an object [commonly referred to as inertia in physics]

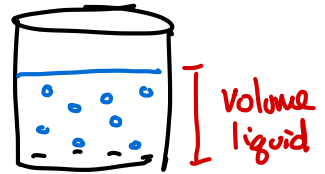
Weight is a property of matter based on how mass is affected by gravity. (How "heavy" an object is)



Volume is the space an object occupies in the universe



Fixed Volume (liquid)



Density of matter is the relationship of mass to volume of an object.

Density Examples



Large # particles
small space
= High Density



Small # particles
large space
= Low Density

$$\text{Density} = \frac{\text{mass}}{\text{volume}} \quad D = \frac{m}{V}$$

Atoms, Compounds, and Molecules

The atom is the most fundamental form of matter. All atoms are based on subatomic particles, or particles smaller than an atom.

Atoms contain the following	<u>Protons (p^+)</u> Identify atom	<u>Neutrons (n^0)</u> Stabilize Atom	<u>Electrons (e^-)</u> Connect Atom
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An element is an atom with a specific number of protons (+)

Sodium (Na) : 11 p^+ (11 protons)	Chlorine (Cl) : 17 p^+ (17 protons)
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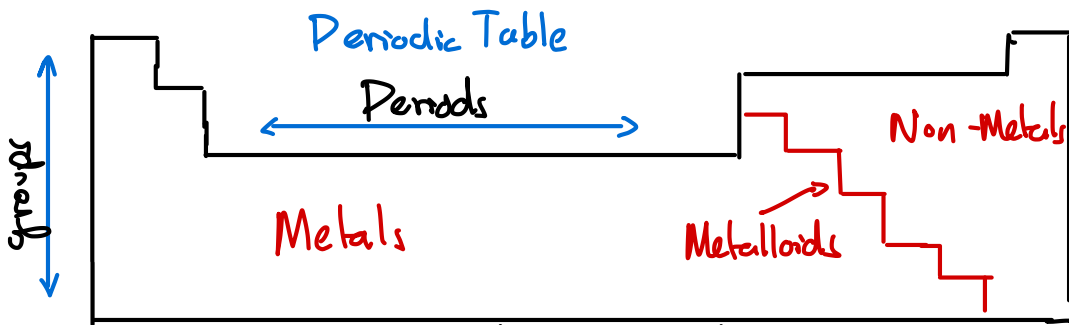
Elements are shown on the Periodic Table, table of elements

11
Na
Sodium
22.99

← $\#p^+$
(Atomic #)
← Symbol
← Name
← Atomic Mass

Squares on the periodic table contain an element's key information ($\#p^+$, symbol, name, atomic mass)

The Periodic Table is arranged into groups (\updownarrow) and periods (\leftrightarrow)



groups are elements that are similar to each other.

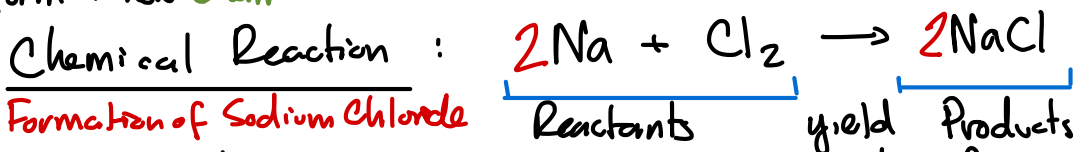
periods are elements that change across the table *

Elements are also organized by type (metal, non-metal, etc.)

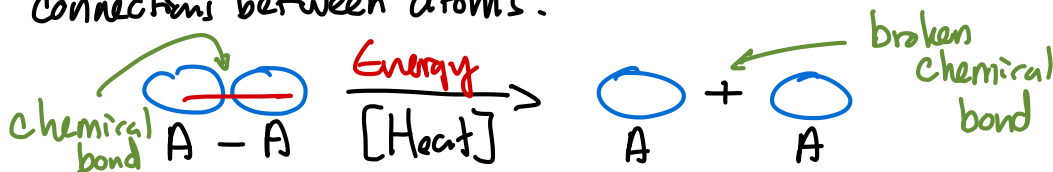
* Increase Size, $\#p^+$, Atomic Structure, Type, etc.

Chemical Reactions

A chemical reaction is a process where atoms **combine** or **break apart** to form a new **chemical structure**.



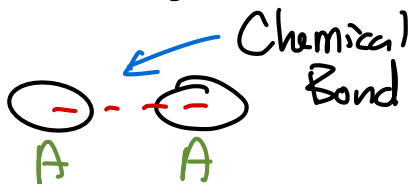
Chemical reactions require energy to break and reform connections between atoms.



Part 2 - States of Matter

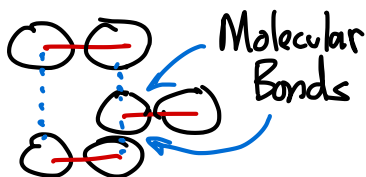
A state of matter is the form that matter takes as it connects to (**bonds**) with other atoms.

Intermolecular Connection



Connection between to atoms **bonded** together

Intramolecular Connection

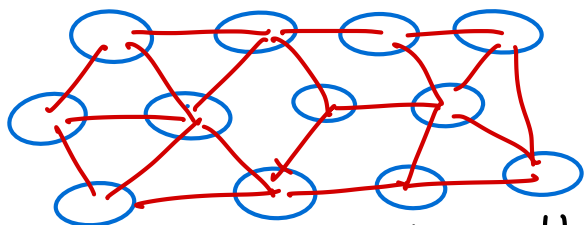


Connections between one of more **compounds/molecules**

States of Matter are the ways intramolecular forces hold different molecules together in matter.

States of Matter - Solids (s)

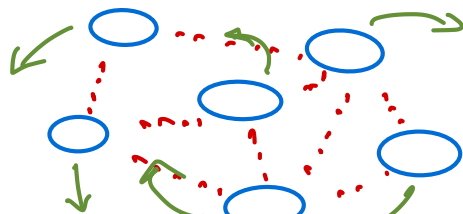
A solid is a state of matter with fixed volume and fixed shape. (Fixed = not changing)



Particles are connected with strong intramolecular forces

States of Matter - Liquids (l)

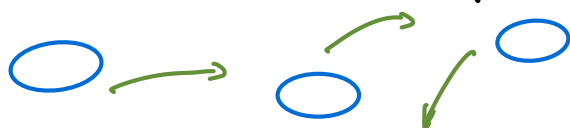
A liquid is a state of matter with fixed volume but variable (changing) shape



Particles flow (break and reform) bonds between atoms

States of Matter - Gas (g)

A gas is a state matter with variable volume and shape.



Particle flow but do not bond with each other.

States of Matter Summary

Solid (s)

Fixed volume / Fixed Shape

Liquid (l)

Fixed volume / Variable Shape

Gas (g)

Variable volume and shape

States of matter is the start of all chemical systems. Energy is required to change state ($s \rightarrow l$, $l \rightarrow s$, $l \rightarrow g$, $g \rightarrow l$).