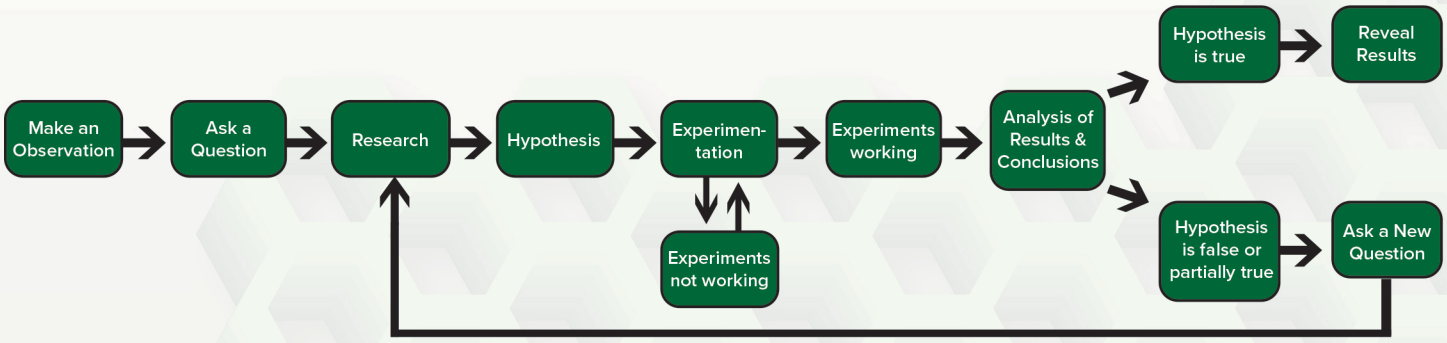
CHAPTER 1 INTRO TO GENERAL CHEMISTRY

THE SCIENTIFIC METHOD

The Scientific Method represents a research method that involve making an observation, identifying a problem, gathering data and information related to that problem, formulating a hypothesis and then constantly testing that hypothesis.



Glossary

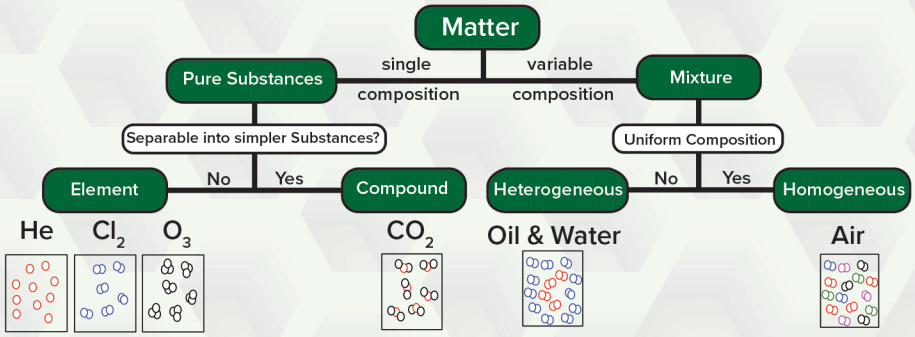
Theory - a test, well-documented, and clear explanation for a set of proven factors.

Hypothesis - an assumption that is made and can be tested to be proven true or false.

Scientific Law - a description for an observed phenonmenon that may explain it, but does not describe it.

THE CLASSIFICATION OF MATTER

The Classification of matter into its 3 physical states (solid, liquid or gas) also includes examining their composition.

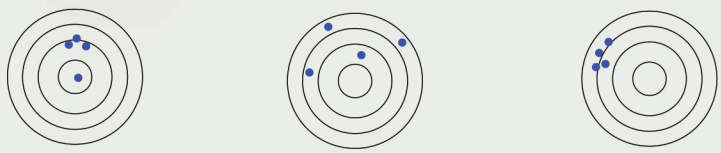


EXPERIMENTAL ERROR

All calculations and measurements done in chemistry have some level of experimental error.

Precision Deals with the reproducibility of the calculations.

Accuracy Deals with how close the measured calculations are to the "actual" or "true" value.



Precise and Accurate | Neither Precise nor Accurate | Precise but not Accurate

METRIC PREFIXES

Metric Prefixes serve as "labels" that can be placed in front of base units.

Peta (P)	10^{15}
Tera (T)	10^{12}
Giga (G)	10^{9}
Mega (M)	10^{6}
kilo (k)	10^{3}
hecto (h)	10^{2}
deca (da)	10^{1}
Base	10^{0}
deci (d)	10^{-1}
centi (c)	10^{-2}
mili (m)	10^{-3}
micro ()	10^{-6}
nano (n)	10^{-9}
pico (p)	10^{-12}
femto (f)	10^{-15}

Liters to kiloliters

$$12.3\ \text{L} \cdot \frac{1\text{kL}}{10^3\ \text{L NaOH}} = 0.0123\text{kL}$$

nm to hm

$$5.17\ \text{nm} \cdot \frac{10^{-9}\text{m}}{1\ \text{nm}} \cdot \frac{1\ \text{hm}}{10^2\text{m}} = 5.17 \times 10^{-11}\text{hm}$$

INTRO TO GENERAL CHEMISTRY

SIGNIFICANT FIGURES

Significant figures are necessary to communicate the level of accuracy with which values are recorded

1 If your number has a **decimal point** move from **left to right.** Start counting once you get to your first non-zero number and keep counting until you get to the end

0.000250 → 3 significant figures

3.012×10^{-6} → 4 significant figures

2 If your number has **no decimal point** move from **right to left.** Start counting once you get to your first non-zero number and keep counting until you get to the end.

72 ← 2 significant figures

315 ← 3 significant figures

CHEMICAL CHANGE

A change in chemical composition that creates new product(s) and is **irreversible.**

$N_2\,(g) + 3\,H_2\,(g) \longrightarrow 2\,NH_3\,(g)$

- Rusting of Metals
- Combustion
- Metabolism of Food
- Burning
- Odor Change
- Reaction Titrations

PHYSICAL CHANGE

A change in the physical state of a substance without a change in composition that is **reversible.**

$CO_2\,(s) \longrightarrow CO_2\,(g)$

- Freezing
- Melting or Fusion
- Condensation
- Vaporization
- Sublimation
- Deposition

CHEMICAL PROPERTIES

A property of matter that is observed during a chemical reaction.

- Flammability
- Toxicity
- Solibility
- Oxidation
- Corrosion
- Radioactivity
- Heat of Combustion
- Enthalpy of Formation
- Reactivity with Water
- Reactivity with Acids

PHISYCAL PROPERTIES

A measurable property that describes the state of a chemical compound

- Color
- Density
- Volume
- Mass
- Ductility
- Boiling Point
- Melting Point
- Luster
- Brittleness
- Concentration

INTENSIVE PROPERTIES

A property of matter that is **independent** of size or amount.

- Color
- Density
- Volume
- Mass
- Ductility
- Boiling Point
- Melting Point
- Luster
- Brittleness
- Concentration

EXTENSIVE PROPERTIES

A property of matter that is **dependent** on size or amount.

- Mole (mol)
- Energy (E)
- Mass (m)
- Volume (V)
- Enthalpy (H)
- Entropy (S)
- Internal Energy (E)
- Gibbs Free Energy (G)
- Heat Capacity (C_P)

TEMPERATURE CONVERSIONS

Temperature is a measure of thermal energy in a substance that is independent of the amount of matter.

Kelvin (K) ⟷ **Celsius (°C)** ⟷ **Farenheit(°F)**

$K = °C + 273.15$ | $°F = 1.8(°C) + 32$

SI BASE UNITS

The International System of Units (SI) provides a list for units of measurement as the foundation from which all other SI units can be derived.

Physical Quantity	Name	Symbol	Description
Mass	kilogram	kg	Equal to the mass of a Pt-Ir alloy prototype constructed in 1885.
Length	meter	m	Distance light travels in a vacuum during 3.335×10^{-9} of a second.
Time	second	s	Related to an atomic transition of Cesium-133.
Temperature	kelvin	K	Defined as the triple point of H_2O as 273.15 K and absolute zero as 0 K
Amount of Substance	mole	mol	Number of particles equal to the number of atoms in 0.012 kg of Carbon-12 ($\sim 6.022 \times 10^{23}$).
Electrical Current	ampere	A	An electric current unit that represents the flow of one coulmob per second.
Luminous Intensity	candela	cd	Measurement of luminous intensity preceptible by the human eye

CONVERSION FACTORS

A conversion factor is a ratio or fraction that ties together two different units.can be derived.

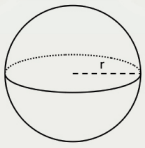
Lenght	1 km = 0.6214 miles 1 m = 39.37 in	1 m = 1.094 yards 1 ft = 30.48 cmt	1 in = 2.54 cm
Volume	1 gallon = 3.785 L 1 L = 1.057 qt	1 L = dm^3	1 mL = 1 cm^3
Mass	1 kg = 2.205 lbs	1 oz = 28.35 g	1 lb = 453.59 g

DENSITY

Density represents the amount of mass per unit of volume.

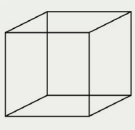
$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

When given the mass of a geometric object you can solve for its volume to find density.



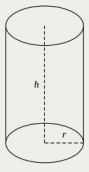
Sphere

$V = \frac{4}{3} \cdot \pi \cdot r^3$



Cube

$V = a^3$



Cylinder

$V = \pi \cdot r^2 \cdot h$

For non-geometric objects water displacement is used to determine the object's volume.