

## CHAPTER 1 – Intro to Chemistry

- Matter** - Anything that takes up space
- Mass** - Measure of matter
- Weight** - Measure of matter with gravity (same as mass on Earth)
- Atom** - The fundamental unit of a chemical substance
- Molecules** - A combination of two or more atoms held together in a specific shape by attractive forces
- Element** - A substance that cannot be separated into simpler substances by chemical or physical means (unique name and number)
- Compound** - Composed of two or more elements (H<sub>2</sub>O; water)
- Mixture** - Combination of two or more substances in which each substance retains its own properties (sea water; salt and water)
- Homogenous = uniform composition throughout the mixture (sugar water) (usually called solutions)
  - Heterogeneous = not uniform composition throughout the mixture
- Phase of matter**
- Gas = no shape or volume
  - Liquid = no shape but has definite volume
  - Solid = definite shape and volume
- Properties**
- Chemical = describe the way a substance may change or react
    - o Solubility, Flammability, Acid/Base
  - Physical = describe the look of the substance without changing the identity and composition of the substance
    - o Color, Odor, Density, Melting pt, Shape, etc
  - Intensive = does not depend on amount of sample
    - o Temperature, density, melting pt
  - Extensive = depends on the quantity (amount) of sample
    - o Mass, volume

Unit of Measurement - Metric system (SI Unit) \*Use in this class

Measurement	SI unit	Symbols	Non-SI unit	Symbols
Mass	Kilogram	kg	Pounds	lbs
Length	Meter	m		
Volume	Liter	L		
Temperature	Kelvin	K		
Time	Second	sec		

**Prefix** - Used in front of the unit

Prefix	Abbr.	Power	Example
Tera	T	10 <sup>12</sup>	1 Tg = 1,000,000,000,000 g
Giga	G	10 <sup>9</sup>	1 Gg = 1,000,000,000 g
Mega	M	10 <sup>6</sup>	1 Mg = 1,000,000 g
kilo	k	10 <sup>3</sup>	1 kg = 1,000 g
hecto	h	10 <sup>2</sup>	1 hg = 100 g
deca	da	10 <sup>1</sup>	1 dag = 10 g
deci	d	10 <sup>-1</sup>	1 dg = 0.1 g

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centi	c	$10^{-2}$	1 cg = 0.01 g
milli	m	$10^{-3}$	1 mg = 0.001 g
micro	μ (Greek)	$10^{-6}$	1 μg = 0.000001 g
nano	n	$10^{-9}$	1 ng = 0.000000001 g
pico	p	$10^{-12}$	1 pg = 0.000000000001 g
femto	f	$10^{-15}$	1 fg = 0.000000000000001g

\*\*No prefix means the power is  $10^0$ .

**Converting** - One prefix to another; multiply by the new prefix and divide by the old prefix

**Scientific notation** - Use of power of 10

- move the decimal to the left (power is +)
- move the decimal to the right (power is -)

**Temperature** - Celsius scale (Used in most countries, except US)

- $0^{\circ}\text{C}$  – freezing water;  $100^{\circ}\text{C}$  – boiling water
- Fahrenheit scale (Used only in US)
- $32^{\circ}\text{C}$  – freezing water;  $212^{\circ}\text{C}$  – boiling water
- $T(^{\circ}\text{F}) = T(^{\circ}\text{C}) \times 1.8 + 32$  [ $^{\circ}\text{C}$  to  $^{\circ}\text{F}$ ]

- Kelvin scale (Absolute temperature) (used in class)

- $T(\text{K}) = T(^{\circ}\text{C}) + 273.15$  [ $^{\circ}\text{C}$  to K]

**Volume** - 1 L = 1000  $\text{cm}^3$ ; 1 mL = 1  $\text{cm}^3$ ; 1 in<sup>3</sup> = 16.4  $\text{cm}^3$

**Density** - amount of mass per volume;  $D = \text{mass/volume (m/v)}$

- Unit =  $\text{g/cm}^3$ ;  $\text{g/mL}$ ;  $\text{kg/m}^3$

**Precision vs.** - Precision = measure of how close # is to each other (exactness)

**Accuracy** - Accuracy = how close to the true value

**Significant** - Digits that show the precision of a measurement

**Figures** - Guidelines to determine sig. Fig.:

1. All non-zero digits are sig. [125 = 3 sig. Fig]
2. Leading zeros: before non-zero digits **are not** sig. [0.00025 = 2 sig. Fig.]
3. Captive zeros: between two non-zero digits are sig. [100.05 = 5 sig. Fig.]
4. Trailing zeros: after a #; are significant only if it contains a decimal point. [101.00 = 5 sig. Fig; 0.0002500 = 4 sig. Fig.]

Rule for + or - - When adding or subtracting, the final answer should the same # of decimal places as the least precise number

Rule for x or ÷ - When multiplying or dividing, the final answer should have the same # as the number with the least # of sig. Figures

**Dimensional** - Converting from one unit to another

**Analysis** - Use conversion factors; example: 1 in = 2.54 cm

- Example: Convert 3.4 inches to centimeter
- $\underline{3.4 \text{ in } 2.54 \text{ cm}} = (3.4 \times 2.54) / 1 = 8.636 \text{ cm} = 8.6 \text{ cm}$

- Conversion factors

- o 1 kg = 2.2046 lb; 1 lb = 453.59 g = 16 oz
- o 1 km = 0.62137 mi; 1 mi = 5280 ft = 1.6093 km
- o 1 gal = 4 qt = 3.7854 L