Intro to Chemistry and Matter

Unit 1 Introduction, Matter and Measurement

Chemistry – is the study of properties and behavior of matter.

There are 5 traditional branches of chemistry:

- Inorganic – the study of chemicals that do not contain carbon.
- Organic – the study of chemicals that contain carbon.
- Analytical – composition of matter, measurable, identifies compounds/components.
- Physical – the study of mechanism, rate, energy transfer that happens when matter undergoes change.
- Biochemistry – study of processes that take place in organisms.

Matter - is anything that has ass and takes up space.

Atoms - are building blocks of matter.

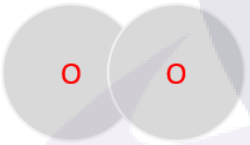
Element - is made of a unique kind of atom.

Examples – Hydrogen, Helium, Carbon, etc. (Basically, everything on the Period able is an element)

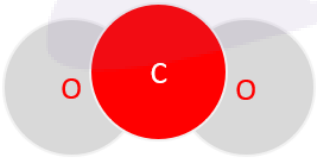
Compound - is made of two or more different kinds of elements.

Examples – water, carbon dioxide, etc. (H_2O, CO_2)

All Elements are listed on a Periodic Table



Element contains just **one type of atom**
In this case it is just 2 Oxygen atoms (O)

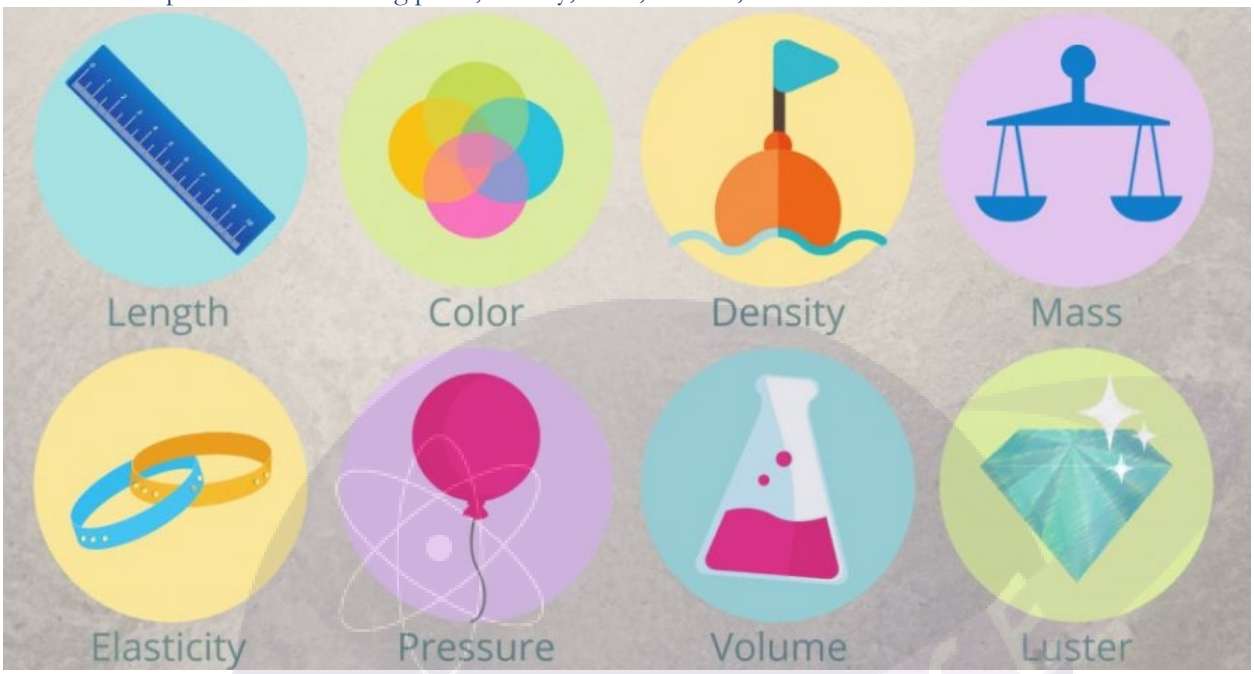


Compound contains **different types of atoms bonded together**
In this case it is an CO_2 compound because there is a Carbon atom (C) and two Oxygen atoms (O)

Types of Properties

Physical Properties can be observed without changing a substance into another substance

Examples – include boiling point, density, mass, volume, color.



Chemical Properties can only be observed when a substance is changed into another substance

Examples – include flammability, corrosiveness, or reactivity with acid.

Mass and Volume

Mass – a measure of the AMOUNT OF MATTER

Volume – is the amount of space matter occupies

Chemistry 1.2

Measurement of Matter and Significant Figures

Types of Data

Quantitative data – numerical observations

Examples: length, mass, weight, concentration, etc. (basically anything with numbers)

Qualitative data – not numerical observations

Examples: bubbling, smooth, opaque, granular, etc. (basically visual features)

Practice:

Reading the following examples and then decide if each statement is Qualitative (QL) or Quantitative (QNT)

1) _____ The flower was red.
2) _____ The screw was 7 cm long.
3) _____ The mass of the beaker was 122 grams.
4) _____ The slug was slimy.
5) _____ I have black hair.
6) _____ I am 5'4 inches tall.

Answer:

1)QL 2)QNT 3)QNT 4)QL 5)QL 6)QNT

Basic Chemistry Measurements

Mass – the amount of "stuff" (matter) in something.

- It does not change based on where the matter is located (same on Earth and the moon)
- Most popular unit is grams
- Mostly measured in a triple beam balance or electronic balance

Volume – how much space matter takes up.

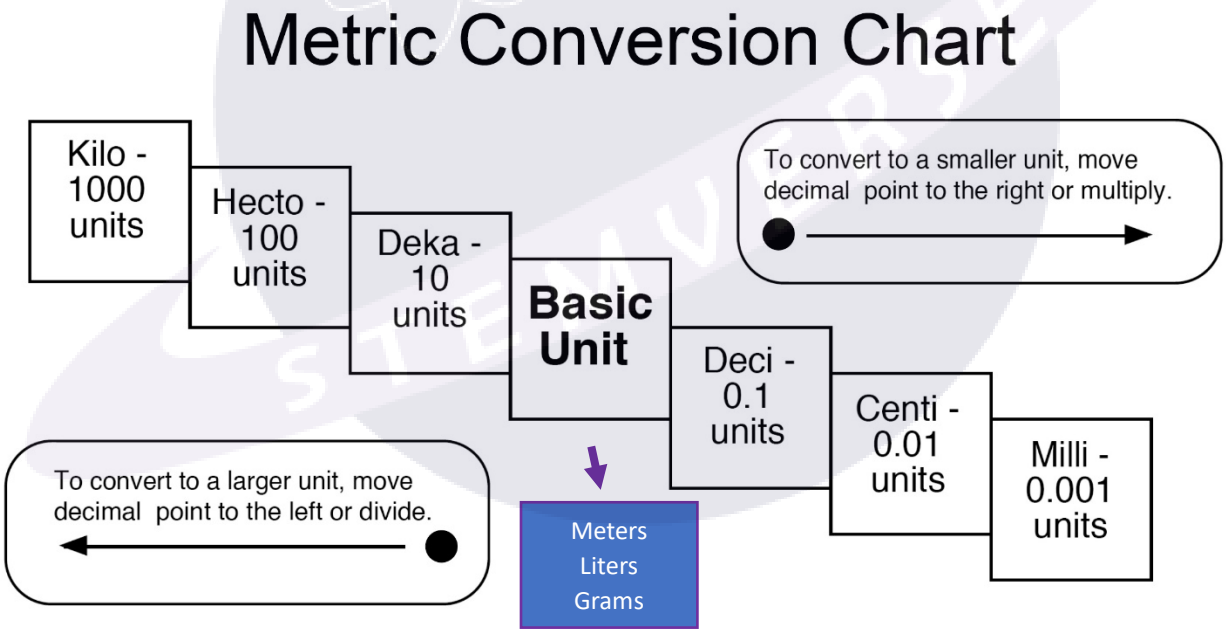
- Most popular unit is liter
- Mostly measured with a graduated cylinder

Weight – a measure of the gravitational field on matter.

- Most popular unit is Newtons
- Changes based on location
  Example: if you weighed 130 lbs on earth, you would be 22 lbs on the moon

Metric System Measurements

In chemistry most all measurements use the Metric System.



To convert between different units, you can use a method called **dimensional analysis**

Dimensional Analysis

Step 1: identify the unit given in the problem

Step 2: determine the unit the answer should be in

Step 3: use the conversion factor

Example:

Convert 6890 grams to kilograms

The unit given to you

The conversion factor: there are 1000 grams in 1 kilogram

$$6890\ grams \times \frac{1\ kilogram}{1000\ grams} = 6.89\ kilograms$$

Multiplying the given unit with the conversion factor cancels out the grams and you are left with the kilograms

Practice:

1020 mg = _____ g 1 L = _____ mL 170 cm = _____ mm

17 km = _____ m 108g = _____ kg 780 m = _____ km

Answers: 1.020g 17000m 1000mL .108kg 1700mm .780km

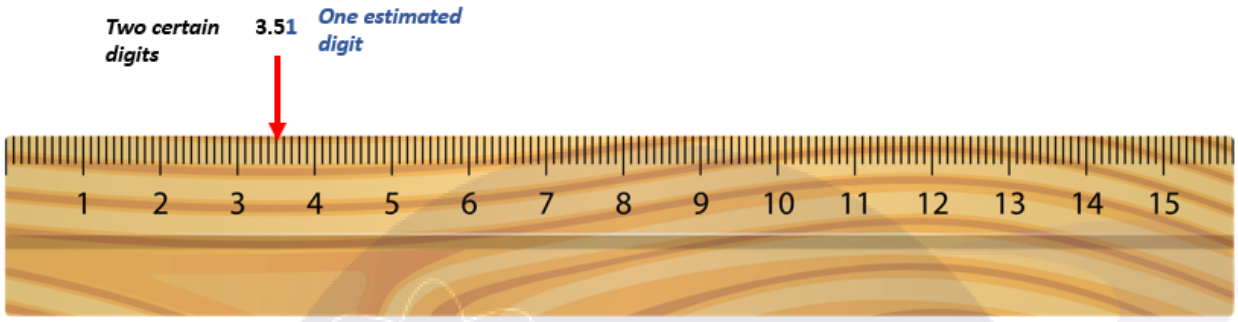
Chemistry Unit 1

Significant Figures

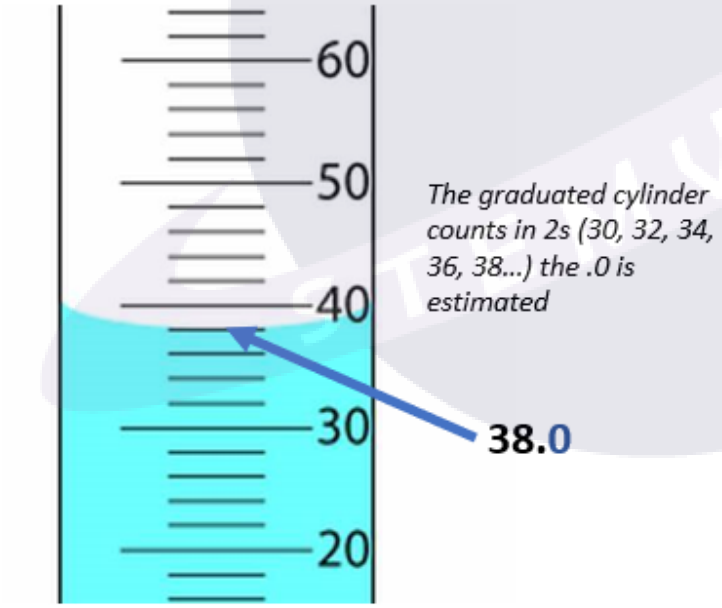
Significant Figures – is used in measurements for precision and accuracy

You measure 1 digit beyond what the measuring device is measuring

Example:



This ruler counts will the tenths place, so you guess the hundredths place. *3.5(we can count and see) 1 (we estimate and guess)*



There is an exception for significant figures. If you are using an electronic measuring device that simply reads the measurement, you can read the measuring number as it is.

Counting Significant Figures

Rules for the number of Significant Figures:

1. **Count all non-zero number**
   Example: the number of 1234 has 4 significant figures
2. **How to count zeros**
   - leading zeros: never count as significant figures

   Examples: .000078 has only 2 significant figures
   - captive zeros: always count as significant figures

   Example: 2.0007 has 5 significant figures
   - trailing zeros: count only if the number had a decimal point

   Example: 100 has 1 significant figure, 100. has 3 significant figures, 100.0 has 4 significant figures

Practice:

Count the number of significant figures in a number.

1) 90.3

2) 0.000338

3) 33.4

4) 0.033002

5) 500

6) 800.0

Answers: 3, 3, 3, 5, 1, 4

Practice:

Round the following to 2 significant figures:

1) 790,230

2) 3902.22

3) 0.0338

4) 6.17×10^4

Answers: 790,000, 3900, 0.034, 6.2×10^4

Chemistry

Unit 1 Calculations with Significant Figures

A number is expressed in scientific notation when it is in the form

$$a \times 10^n$$

where **a** is between 1-10 and **n** is an integer

Examples:

780,000,000.

- To make this number between 1-10 the decimal point should be between 7 and 8

7.80,000,000

- How many decimal places did you move?
  8 places

Answer: 7.8×10^8

0.0000045

-The decimal should be between 4 and 5 to make the number between 1-10

000004.5

- How many places did the decimal move?
  6 places

Answer: 4.5×10^{-6}

Exponent is negative because the decimal point moved to the right

Practice:

Write 687566.3 in Scientific Notation

Answer: 6.875663×10^5

Adding and Subtracting with Significant Figures in account

For adding and subtracting, ONLY the decimal portion of the number matters.

1) Count the number of significant figures after the decimal point (to the right side of the decimal point) of each number in the problem.
2) Add and subtract both the given numbers.
3) The answer should have the LEAST number of places after the decimal point of any number in the problem.

Example

13.24 + 12.3 = 25.54

Round the 25.54 to 25.5 because the least number of places is tenths place

Answer: 25.5

Practice:

0.6875 – 0.1 =

Answer: .6

4.56 – 2 =

Answer: 2

0.643 - 0.53 =

Answer: 0.11

Multiplying and dividing with Significant Figures in account

1) When multiplying or dividing the LEAST number of significant figures in any number of the problem determines the number of significant figures that should be in the answer

Example:

2.33 × 1.5 = 3.4

Since the least number of significant figures is two, the answer only has two significant figures.

Practice:

7.65 × 9.1 =

Answer: 70.

4.536 × 2000 =

Answer: 9000

0.09 ÷ 0.53 =

Answer: 0.2