

Unit 1: Safety and Measurement

Resources:

- ✓ Laboratory Equipment List
- ✓ Chemistry lab - Safety Guidelines

Key Terms:

- ✓ Observation - *a detailed examination of a property or phenomenon*
- ✓ Inference - *a conclusion based on observations and/or prior knowledge*
- ✓ Quantitative observations - *measurements*
- ✓ Qualitative observations - *non-numerical observations*
- ✓ Accuracy - *the ability of a measurement to approximate the true or accepted value*
- ✓ Precision - *the ability of a measurement to be consistently reproduced*
- ✓ Density - *the amount of matter in a given amount of space*

Rules for Significant Figures:

- ✓ *When measuring, always report one digit more than the smallest increment on the tool. For example, a graduated cylinder marked in 1mL increments should always report volumes to the tenths place.*
- ✓ *When multiplying or dividing, the product or quotient should be reported with the same number of significant figures as the measurement with the fewest significant figures.*
- ✓ *When adding or subtracting, the sum or difference should be reported with the same number of decimal places as the measurement with the fewest decimal places.*

1. All non-zero digits are significant
2. Trailing zeroes after the decimal are significant
3. Zeroes between significant digits are significant

The International System of Units:

Measurement	Unit	Standard
Length (l)	meter (m)	The distance light can travel in a vacuum in 1/299792458 s
Mass (m)	kilogram (kg)	The international prototype kilogram in Sevres, France
Time (t)	second (s)	The duration of 9,192,631,770 periods of radiation corresponding to the transition between two hyperfine levels of the ground state of cesium-133
Temperature (T)	Kelvin (K)	1/273.16 the temperature of the triple point of water, with the null value residing at absolute zero (-273.15°C)
Amount (amt)	mole (mol)	The number of atoms in exactly 12g of carbon-12. Avogadro's number = 6.022×10^{23} particles

Metric Prefixes:

Prefix	Abbreviation	Meaning	Multiplier	Relationship
Tera	T	Trillion	$\times 10^{12}$	1 Teraunit = 1,000,000,000,000 units
Giga	G	Billion	$\times 10^9$	1 Gigaunit = 1,000,000,000 units
Mega	M	Million	$\times 10^6$	1 Megaunit = 1,000,000 units
Kilo	k	Thousand	$\times 10^3$	1 Kilounit = 1,000 units
<i>Hecto</i>	<i>H</i>	<i>Hundred</i>	$\times 10^2$	<i>1 Hectounit = 100 units</i>
<i>Deca</i>	<i>D</i>	<i>Ten</i>	$\times 10^1$	<i>1 Decaunit = 10 units</i>
--unit--				
deci	d	tenth	$\times 10^{-1}$	1 unit = 10 deciunits
centi	c	hundreth	$\times 10^{-2}$	1 unit = 100 centiunits
milli	m	thousandth	$\times 10^{-3}$	1 unit = 1,000 milliunits
micro	μ	millionth	$\times 10^{-6}$	1 unit = 1,000,000 microunits
nano	n	billionth	$\times 10^{-9}$	1 unit = 1,000,000,000 nanounits
pico	p	trillionth	$\times 10^{-12}$	1 unit = 1,000,000,000,000 picounits

Dimensional Analysis:

A problem solving method that can be used to relate one measurement to another (ie, unit conversions). This is done by multiplying the initial measurement by a series of equivalencies organized in such a way that the units are algebraically cancelled.

Example:

How many minutes in one year?

$$1 \text{ year} \times \frac{365 \text{ days}}{1 \text{ year}} \times \frac{24 \text{ hours}}{1 \text{ day}} \times \frac{60 \text{ min}}{1 \text{ hour}} = 525,600 \text{ min}$$

Graphical Analysis:

- ✓ Pie graph - used to display relationships expressed as parts of a whole (percentages)
- ✓ Histogram - used to display the number of data points in a particular category
- ✓ Line graph - used to display the change in a measurement over time
- ✓ Scatter plot - used to display a mathematical relationship between two measurements

- ✓ Best fit line - A straight line drawn through a scatter plot that most closely approximates every data point. The slope of the line often reveals important details about the relationship between the independent (x) and dependent (y) variables.