MEASUREMENTS AND MATTER

Chemistry
Study of the composition of matter and the changes it undergoes

ALL LIVING AND NONLIVING THINGS ARE MADE OF MATTER... CHEMISTRY AFFECTS EVERYTHING!!!
Branches of Chemistry

- **ORGANIC**: study of chemicals containing carbon
- **INORGANIC**: study of chemicals that do NOT contain carbon
- **ANALYTICAL**: focuses on the composition of matter
- **BIOCHEMISTRY**: study of processes that take place in organisms
- **PHYSICAL**: focuses on the mechanisms, rate, and energy transfer that occurs when matter undergoes a change

Types of Chemistry

**PURE CHEMISTRY**
Pursuit of chemical knowledge for its own sake

**APPLIED CHEMISTRY**
Research toward a practical goal or application (ex: developing a new drug)
Observations

**QUALITATIVE**
Describes the qualities
(ex: color, smell, shape, etc.)

**QUANTITATIVE**
Numeric, requires number and unit!
(ex: mass, length, volume, etc.)

Scientific Notation

- Short cut for writing big or small numbers
- Always contains a number greater than 1 and less than 10 followed by \( \times 10^N \) (\( N = \) a number)

  - Move the decimal (left or right) until the number is between 1 and 10 AND the number of spaces moved will = \( N \)
  - If no decimal is present, assume it is at the end!

  **Move LEFT:** \( N \) is **POSITIVE**
  **Move RIGHT:** \( N \) is **NEGATIVE**
Scientific Notation

• **EXAMPLE:**

\[ N = 7 \]

\[ 36500000 \]

\[ 3.65 \times 10^7 \]

- Need to move decimal until number is between 1 and 10
- Which way is it moving?
- Count the number of spaces moved (N) to give \( X \times 10^N \)

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Scientific Notation

• **MORE EXAMPLES:**

a) 0.00002789 \[ 2.789 \times 10^{-5} \]

b) 1,230 \[ 1.23 \times 10^3 \]

c) 99,800,000,000 \[ 9.98 \times 10^{10} \]

d) 0.0071 \[ 7.1 \times 10^{-3} \]

• **Express** \[ 3.13 \times 10^6 \] **in STANDARD NOTATION:**

Move decimal \text{OPPOSITE} as before! \[ 3,130,000 \]
Accuracy vs. Precision

**ACCURACY**
Closeness to the true value

**PRECISION**
How close a series of measurements are to each other

*Tools with MORE numbers after the decimal = MORE precise

WHEN MAKING MEASUREMENTS, IT’S GOOD TO HAVE BOTH!!
Accuracy vs. Precision

ACCURATE AND PRECISE

Accuracy vs. Precision

NOT ACCURATE, BUT PRECISE
Precise vs. Imprecise

• Example:
  Mass of silver = 1.2354 g
  Mass of silver = 1.2 g

  MORE precise measurement will have
  MORE numbers after the decimal,
  this means the device is more
  sensitive!

• Which is the more precise measurement?
  4.609 Liters  4.6 Liters
  5 Liters

% Error

Compare a measurement to its accepted value

\[
\text{% Error} = \left(\frac{\text{Experimental Value} - \text{Accepted Value}}{\text{Accepted Value}}\right) \times 100
\]

• EXAMPLE:
  Sally found the mass of a 34.0 g sample to be 32.7 g.
  What is the % error in her measurements?

  3.82%