Unit 1
Moles, substances, and mixtures

Ch 3.3, 3.4, 3.5
1.1, 1.2,, 1.3

Moles

Rank the amounts below in order of
1. Increasing number of particles
2. Increasing mass
3. Increasing mole amounts

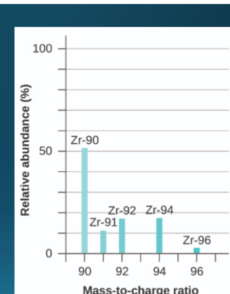
A. 1.0 mol carbon
B. 18 g carbon monoxide
C. 3.0 x 10^{23} molecules of water
D. 10. L oxygen gas at STP

Pure substances—Elements

- Smallest unit—atoms
- Weighted average to determine average atomic masses and molar masses

Mass spectroscopy

- What do you notice? What do you wonder?
- Enables determination of identity and relative abundances of isotopes in sample of element using mass spectroscopy



https://cnx.org/contents/havxkyvS@9.58:ZV-IsnqQ@8/Atomic-Structure-and-Symbolism

Compounds

- Smallest units

Compounds --Percent composition

- Percent by mass of each element in a compound
- $C_{12}H_{22}O_{11}$
- 42.10% C, 6.479% H, 51.42% O

Compounds

- **Law of definite proportions**
- A compound composed of 1.0 g carbon and 1.3 g oxygen is the same compound as one containing 12 g carbon and 16 g oxygen
- **Law of multiple proportions**
- A compound composed of 1.0 g carbon and 1.3 g oxygen has a different composition from one that contains 1.0 g carbon and 2.7 g oxygen

Compounds—Empirical formulas

Lowest whole number ratio of atoms in a molecule

Steps to calculate EF:

1. % → g
2. g → mol
3. Divide by smallest # of moles
4. Use whole numbers (multiply if necessary) to write EF

Compounds—Empirical formulas

Determine the empirical formula for a compound that is 40.92% carbon, 4.58% hydrogen, and 54.50% oxygen by mass.

$C_3H_4O_3$

Compounds—Molecular formulas

A compound has an empirical formula of $C_3H_4O_3$ and a molecular mass of 264.31 g/mol. Calculate the molecular formula.

$C_9H_{12}O_9$

Compounds—Elemental analysis

- Analyze the products of combustion to determine the formula of a compound containing carbon and hydrogen (and oxygen)

$$C_xH_yO_z + O_2 \rightarrow CO_2 + H_2O$$

Compounds—Elemental analysis

- A sample of rubbing alcohol is composed of carbon, hydrogen, and oxygen. Combustion of 0.255g of rubbing alcohol yields 0.561 g of carbon dioxide and 0.306 g of water. Calculate the empirical of rubbing alcohol.

- C_3H_8O

Mixtures

- Proportions vary
- Analyze composition
- Heterogeneous vs homogeneous
- Solutions