Mass of Compounds & The Mole

Outcomes:

- Calculate the mass of compounds in atomic mass units
- Describe the concept of the mole and it's importance to measurement in chemistry.
- Calculate the molar mass of various substances.

Atomic Mass

Since atoms are so **SMALL**, we cannot measure their **MASS** in **LBS** or **KG'S**.

0.00000000000000000000000167

We created a new unit called an **ATOMIC MASS UNIT** (**amu** or **µ**). 1 amu = **1.67×10^{-24}g**

This value is found on your periodic table: 1 C atom = **12.0 amu**

Chemical Formulas:

- Recall that the **NUMBER** of **ATOMS** of each **ELEMENT** in a chemical formula are indicated by **SUBSCRIPTS**.
- I.e. $C_9H_8O_4$ (asprin) has **9** C-atoms, **8** H atoms, and **4** O-atoms

Chemical Formulas:

Molecular vs. Ionic Compounds:

- **MOLECULAR** compounds (molecules) contain atoms linked together by **COVALENT BONDS** (electrically **NEUTRAL**).

- **IONIC** compounds are **NOT MOLECULES** because they are composed of **IONS**.

  - Ie. You can have **WATER MOLECULES**, but you can't have **SALT MOLECULES**.

Mass of Compounds:

6.02×10^{23}

602000000000000000000000

Molecular Mass

The **SUM** of **ATOMIC MASSES** of atoms in a **MOLECULE**.

$C_9H_8O_4 = (12 \times 9) + (1.01 \times 8) + (16 \times 4) = 180.08$ amu

Formula Mass

Is the **SAME** as **MOLECULAR** mass, but with **IONIC** compounds.

$Na_2S = (23 \times 2) + 32.1 = 78.1$ amu

NOTE:

The terms **MOLECULAR** mass, **FORMULA** mass, **MOLECULAR** weight, and **FORMULA** weight are often interchangeable.

The Mole

A unit used to describe **ENOUGH** **ATOMS** to **EQUAL** the **ATOMIC** **MASS**(or formula mass) in **GRAMS**.

Designed to be a convenient multiple like a "**DOZEN**".

Ex) 1 molecule of sugar ($C_{12}H_{22}O_{11}$) weighs 342.34 amu.

→ We **CANNOT** measure **AMU**

→We **CAN** measure **GRAMS**!

The **NUMBER** of **MOLECULES** it takes to have **342.34 GRAMS** of **SUGAR** is **1 MOLE**!

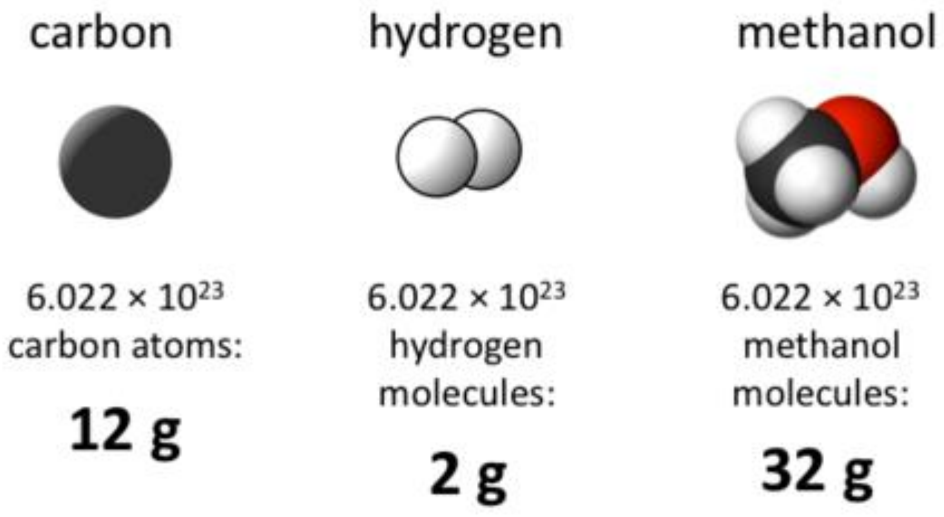
The mole explained!

Molar Mass

Same as **FORMULA** mass, but with units **g/mol**

- Is the **MASS** of **1 MOLE** of a **SUBSTANCE** (like the 342.34g above).
- One **CARBON** atom weighs **12 AMU**, but an **AMU** is very small, and difficult to **MEASURE**.
- A **HUGE NUMBER** of carbon **ATOMS** will weigh **12g**, and we call that **NUMBER** of atoms a **MOLE**.

6.02 x 10^{23} atoms = 1 mole **AVOGADRO'S NUMBER** (N_A)



Molar Mass Calculations

Found by **ADDING** the **ATOMIC MASS** of all atoms in a molecule.

Examples:

Find the mass of one mole of the following:

$MgCO_3$ $= 24.3 + 12 + (16 \times 3) = 84.3 \frac{g}{mol}$

$Ca_3(PO_4)_2$ $= (40.1 \times 3) + (31 \times 2) + (16 \times 8) = 310.3 \frac{g}{mol}$

Molecular mass = mass of 1 molecule => amu

molar mass = mass of 6.02×10^{23} molecules => g/mol