The Mole

- Chemists deal with large amounts of atoms because atoms are so small

- measure the mass of different atoms using amu

1 amu = 1 p+
1 amu = 1 n

Molecular Mass — **Formula Mass**

These are the same except...

Covalently bonded substances (H_2O) — 2 nonmetals

Ionically bonded substances (NaCl) — metal + nonmetal

To solve for these items....
- must add all the individual atomic masses up for each substance

H_2O: H 1.01 x 2 = 2.02 + O 15.99 x 1 = 15.99 → 18.01 amu

Na = 22.99 x 1 = 22.99 + Cl = 35.45 x 1 = 35.45 → 58.44 amu

Find the molecular mass for glucose ($C_6H_{12}O_6$)

C = 12.01 x 6 → 72.06 amu
H = 1.01 x 12 → 12.12 amu
+
O = 15.99 x 6 → 95.94 amu
180.174 amu

Find the formula mass for $CaCl_2$

Ca = 40.08 x 1 = 40.08 amu
Cl_2 = 35.45 x 2 = 70.90 amu
110.98 amu

-We would like to measure things in grams, but atoms are too small to use grams and we often do not deal with just one atom or molecule

- Chemists came up with THE MOLE

1 mole = 6.02 x 10^{23} anything

12 of anything = Dozen
2 of anything = pair / couple
6.02 x 10^{23} of anything = mole

What is 6.02 x 10^{23} ?

AVOGADRO'S NUMBER

- THE # OF PARTICLES IN EXACTLY 1 MOLE OF A PURE SUBSTANCE !!!

6.02 x 10^{23} atoms = 1 mol atoms
6.02 x 10^{23} molecules = 1 mol molecules
6.02 x 10^{23} ions = 1 mol ions
6.02 x 10^{23} cars = 1 mol cars

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1 mole of any compound = the molecular mass or formula mass of that substance in grams

Molar mass

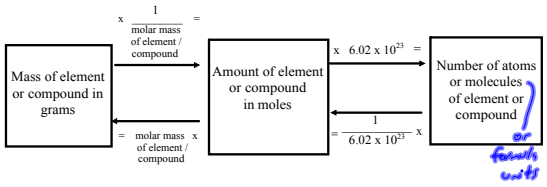
- The mass of one mole of a pure substance

Units = g/mol

- The molar mass is numerically equal to the atomic mass of the element in amu (Found on the periodic table)

What is the molar mass for the following elements:

Li → 6.94 g/mol
He → 4.003 g/mol
Hg → 200.59 g/mol
Ar → 39.95 g/mol
Au → 196.97 g/mol



What is the mass in grams of 3.50 mol of copper?

$$3.50 \text{ mol Cu} \left| \frac{63.55 \text{ g Cu}}{1 \text{ mol Cu}} \right. = 222 \text{ g Cu}$$

A chemist produced 11.9 g of Aluminum. How many moles of aluminum were produced?

$$11.9 \text{ g Al} \left| \frac{1 \text{ mol Al}}{26.98 \text{ g Al}} \right. = .441 \text{ mol Al}$$

72.4 g NaCl → moles

$$72.4 \text{ g NaCl} \left| \frac{1 \text{ mol NaCl}}{58.44 \text{ g NaCl}} \right. = 1.24 \text{ mol NaCl}$$

52.4 g C_2H_6 → molecules

$$52.4 \text{ g } C_2H_6 \left| \frac{1 \text{ mol } C_2H_6}{30.08 \text{ g } C_2H_6} \right| \frac{6.02 \times 10^{23} \text{ molecules } C_2H_6}{1 \text{ mol } C_2H_6}$$

1.96 x 10^{25} O_2 molecules → moles

1.05 molecules C_2H_6

1.05×10^{24} molecules C_2H_6

Moles of Chalk:

Weigh a piece of ordinary chalk and each person write your name on the blackboard.

Weigh thechalk again, and determine the number of moles of calcium carbonate that were used.

Weight of chalk before writing your name: _____

Weight of chalk after writing your name: _____

Grams of chalk required to write your name: _____

I needed _____ moles of calcium carbonate to write my name on the blackboard