The MOLE

What is a dozen?
....a ream?
...a gross?
...a pair?

...a mole?

A mole is 6.022×10^{23} of something

A mole is a very big number:

- 1 mole of marbles stacked over the United States would be 70 miles thick!

A mole can be used to measure anything, just like a dozen

You can have a **dozen** donuts

- ... or a dozen eggs
- ... or a dozen DVDs

You can have a **mole** of donuts

- ... or a mole of eggs
- ... or a mole of DVDs
- ... or a mole of atoms
- ... or a mole of molecules
- ... or a mole of electrons
- ... or a mole of particles

We use it in chemistry because dealing with a mole of atoms is more convenient than dealing with just one atom.

If you express atomic mass in grams instead of amu, than you have one **mole** of atoms.

1.0001 g of H = 6.022×10^{23} atoms = 1 mole H = 1 mol H

mol is abbreviation for mole

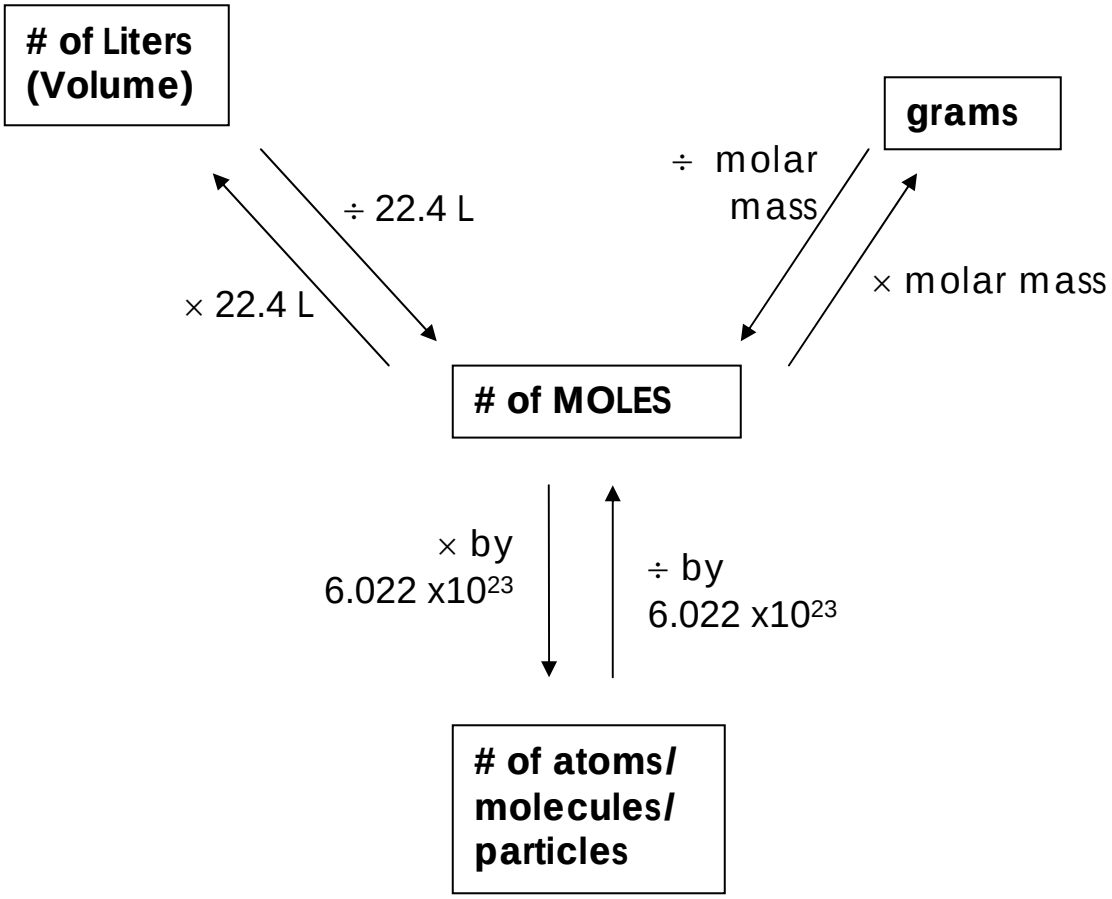
How much is 1 mole of salt?
How much is 1 mole of water?

How many moles in 27.0 g of Aluminum foil?

Avogadro's Hypothesis:
An Italian scientist in the 1800's hypothesized that a given volume of gas contained the same number of particles, no matter what the gas is.

In chemistry, moles are VERY important! From here on out you will rarely do problems where you do not have to calculate in moles.

The MOLE MAP



Example 1:

How many grams in 1 mole of Copper?

1. According to MOLE MAP to get from moles to grams we need to multiply by molar mass
2. Look at periodic chart for molar mass (63.546 **g/mol**)
3. Solve:
    a. moles x molar mass = 1 mol x 63.546 g/mol =
    b. 63.546 grams in 1 mole of Copper

How many grams in 2.0000 moles of Copper?
How many grams in 2.5 moles of Copper?

Answer:
2 moles of Copper = 127.09 grams (watch out for sig figs!)
(Do not consider number of sig figs of exact numbers)
2.5 moles of Cu = 158.87 grams (Always use units!!)

Example 2:
How many atoms in 1 mole of Copper

1. According to the MOLE MAP to get from moles to atoms you must multiply by 6.022×10^{23}
2. 1 mole Cu * (6.022×10^{23})atoms/mole = 6.022×10^{23} atoms

How many atoms in 2 moles of Copper?
How many atoms in 2.5 moles of Copper?

Answer:
2 moles of Copper = 1.204×10^{24} atoms
2.5 moles of Cu = 1.506×10^{24} atoms

Example 3:
How many atoms in 24.022 grams of Carbon?

1. According to the MOLE MAP there is no direct route from atoms to grams. You must go through moles...
2. To get from grams to moles you need to divide my molar mass.
3. Look at the periodic chart to get molar mass of Carbon (12.011 g/mol)
4. Solve: 24.022 g ÷ 12.011 g/mol = 2.0000 moles
5. According to the MOLE MAP to get from moles to atoms you multiply by 6.022×10^{23}
6. Solve: 2.0000 moles * (6.022×10^{23}) atoms/mole = 1.204×10^{24} atoms.