In the next chapter called "Stoichiometry" we will start doing <u>quantitative</u> problems with the reactions we are learning to write during this current "Reactions" chapter. We will start figuring out problems like "if I start with 15g of this reactant, how many grams of that product can I make?" In order to help with the transition to that chapter, we need to pause and review our molar mass and molar conversions topics.

N25 - Molar Mass and Molar Conversions

Target: I can perform molar conversions using dimensional analysis to convert between grams, moles, molecules, etc

Link to YouTube Presentation https://youtu.be/zrkVCPbbqeI

The Mole a.k.a Avogadro's Number

1 mole = 6.02×10^{23} objects

602,000,000,000,000,000,000,000

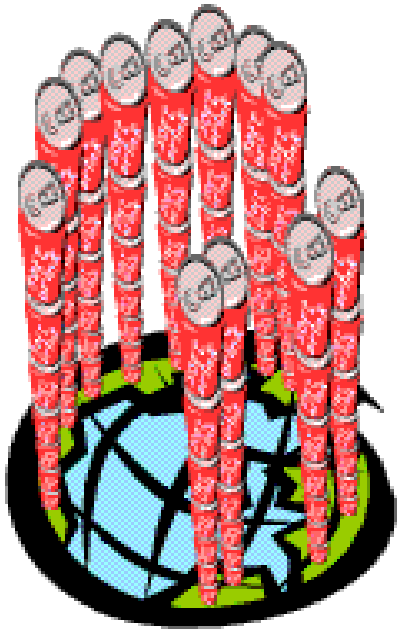
Amedeo Avogadro 1776 – 1856

Decided that:

6.02×10^{23} molecules per mole

Just how big is a mole?

- **Soda cans to cover the surface of the earth over 200 miles deep.**
- **Avogadro's number of unpopped popcorn kernels spread across the USA…over 9 miles deep.**
- **Count atoms at the rate of 10 million per second, it would take about 2 billion years to count the atoms in one mole.**



Molar Mass

1 mole = 6.02×10^{23} objects

How much does ONE MOLE of something weigh?

1 atom of Hydrogen = 1.01 amu*
1 MOLE of Hydrogen = 1.01 grams

1 atom of Carbon = 12.01 amu
1 MOLE of Carbon = 12.01 grams

Use Periodic Table!

***"Atomic mass unit" = 1.661×10^{-24} grams**

Picking 1 mol = 6.02×10^{23} makes it so we don't need to manually do the conversion each time! That's why it's a random number!

Molar Mass

Multiple atoms in a molecule? Add up their individual masses to find molar mass of molecule

CO_2 = 1 carbon + 2 oxygens

Molar mass CO_2 = 12.01g + 2(16.00g)

= 44.01g *per ONE mole*

= 44.01 g/mol

Use Periodic Table!

Molar Mass

Careful with parenthesis!

$(NH_4)_2S = 2N + 8H + 1S$

Molar mass = 2(14.01) + 8(1.01) +1(32.07)

$(NH_4)_2S$

= 68.17g ***per ONE mole***

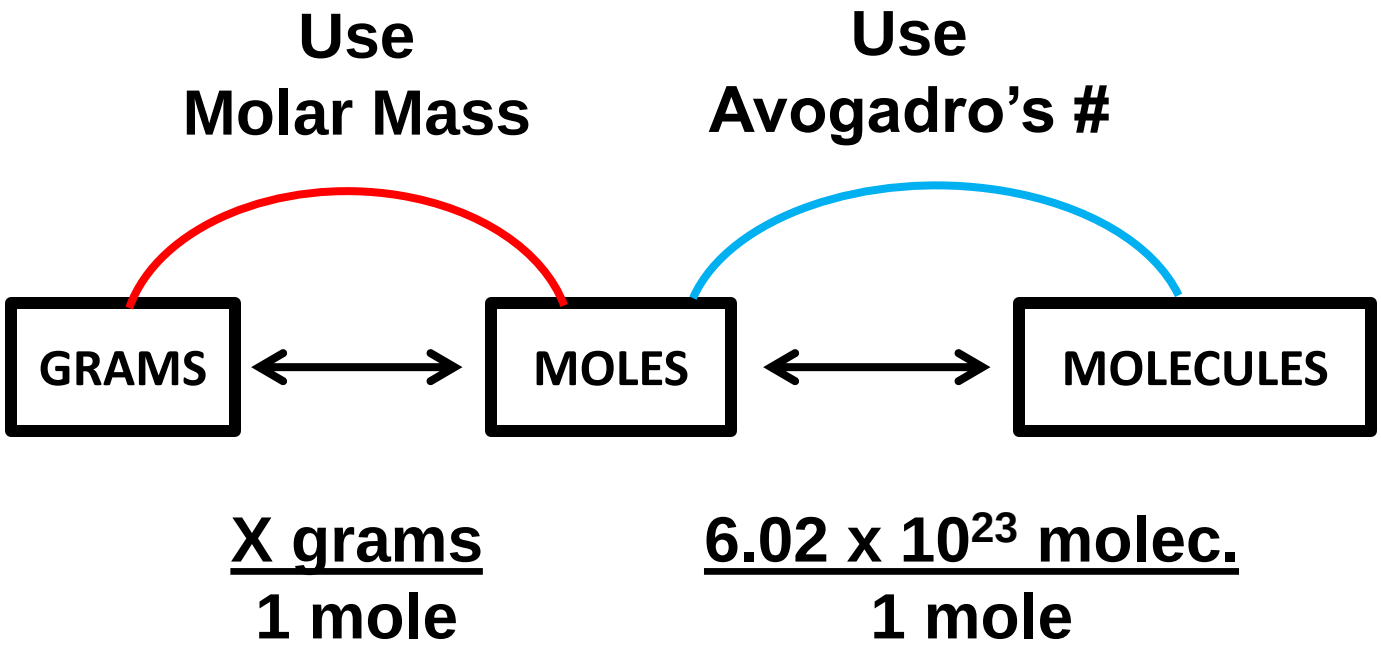
Use Periodic Table!

= 68.17 g/mol

Molar Conversions

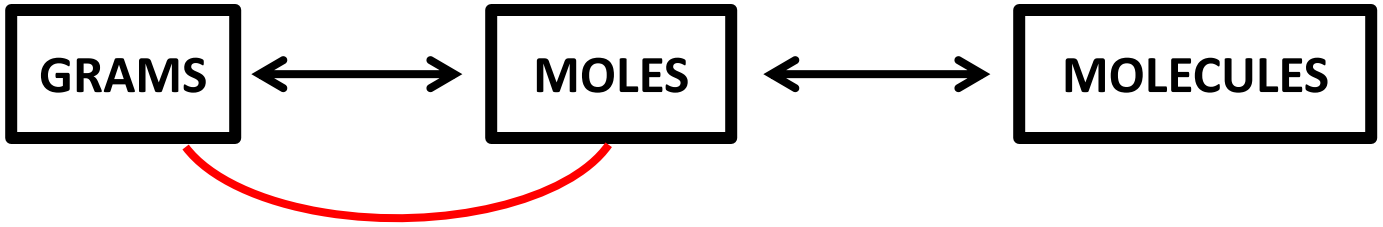
Conversions related to moles

Use DA!



Moles → Grams

How many grams does **1.7** moles of NaCl weigh?



Use Molar Mass

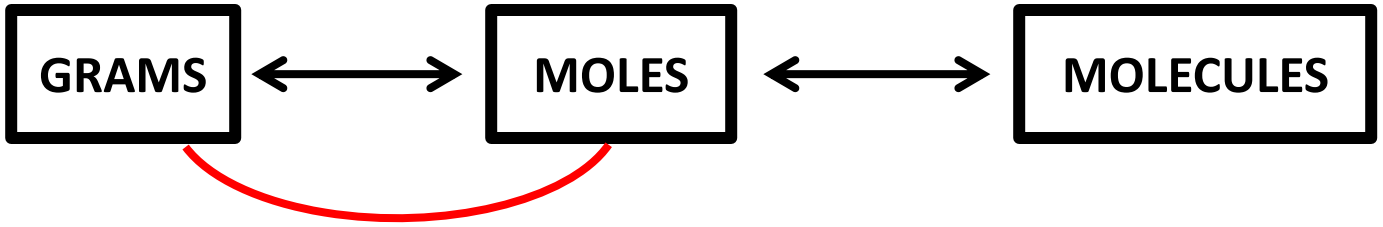
mm = (22.99) + (35.45)
= 58.44 g/mol

$$\frac{1.7 \text{ moles}}{1 \text{ mol}} \times \frac{58.44 \text{ g}}{}$$

= 99.35 g

Grams → Moles

How many moles are in **14** g of CO_2?



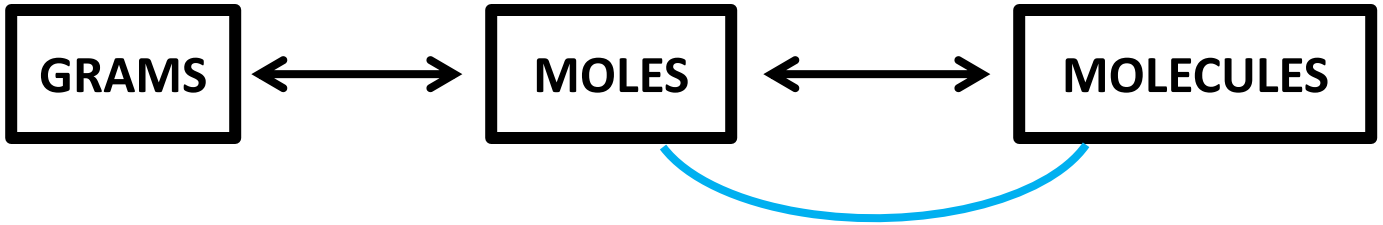
Use Molar Mass

mm = (12.01) + (2 x 16.00)
= 44.01 g/mol

$$\frac{14 \text{ grams}}{44.01 \text{ g}} \times \frac{1 \text{ mol}}{} = 0.32 \text{ mol}$$

Moles → Molecules

How many molecules are in **5.3** moles of H_2O?



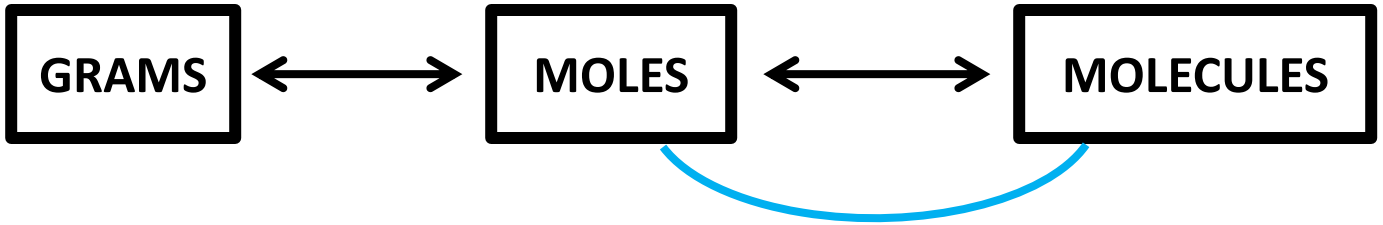
Use Avo.'s # **6.02×10^{23} molec./mol**

$$5.3 \text{ moles} \times \frac{6.02 \times 10^{23} \text{ molec.}}{1 \text{ mol}}$$

$= 3.19 \times 10^{24}$ molecules

Molecules → Moles

How many moles are in **3.17 x 10^{43}** molecules?



Use Avo.'s # **6.02 x 10^{23} molec./mol**

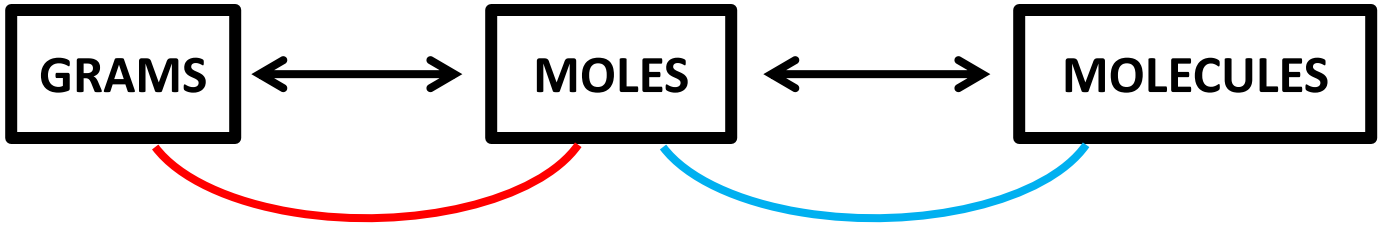
$$\frac{3.17 \times 10^{43}\ \text{molec.}}{} \times \frac{1\ \text{mol}}{\left(6.02 \times 10^{23}\ \text{molec.}\right)}$$

= 5.27 x 10^{19} moles

Use parenthesis!!!!

Grams → Molecules

How many molecules are in **45** grams of H_2O?



Use Molar Mass = 18.02 g/mol

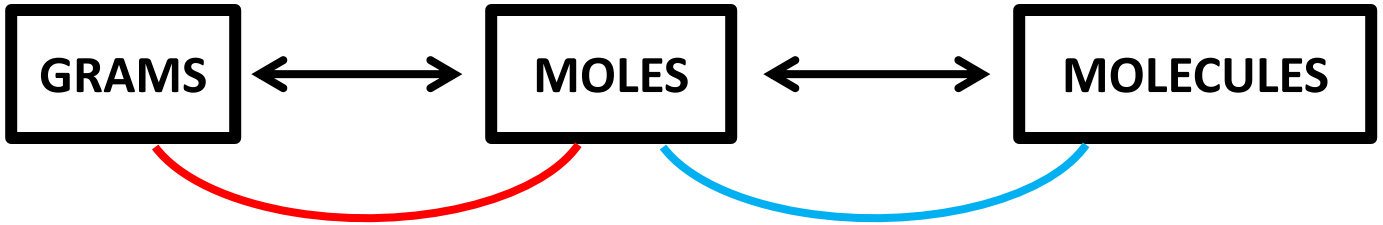
Use Avogadro's #

$$\frac{45\ g}{} \times \frac{1\ mol}{18\ g} \times \frac{6.02 \times 10^{23}\ molec.}{1\ mol}$$

$= 1.51 \times 10^{24}$ molecules

Molecules → Grams

How many grams in **2.6 x 10^{25}** molecules of CH_4?



Use Molar Mass = 16.05 g/mol

Use Avogadro's # = 6.02 x 10^{23} molec./mol

$$2.6 \times 10^{25}\ \text{molec.} \times \frac{1\ \text{mol}}{6.02 \times 10^{23}\ \text{molec.}} \times \frac{16.05\ \text{g}}{1\ \text{mol}}$$

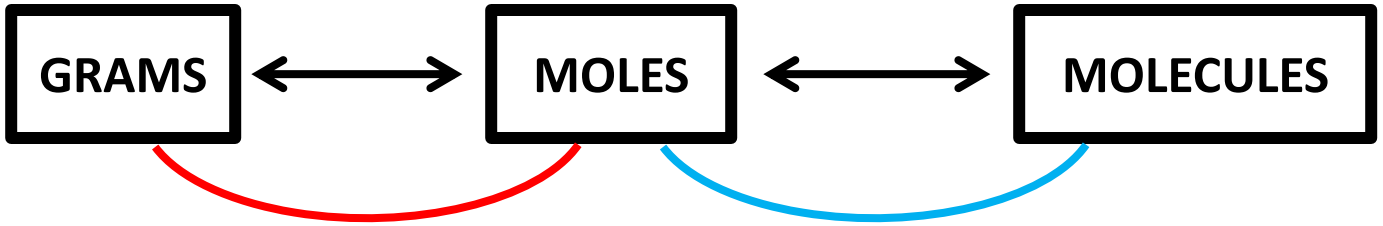
= 693.19 grams

Use parenthesis!!!!

REMEMBER!

You can use "particles" instead of molecules to be generic! Counting atoms? Use atoms!

Still use the number 6.02x10^{23} though!



Use Molar Mass

Use Avogadro's #

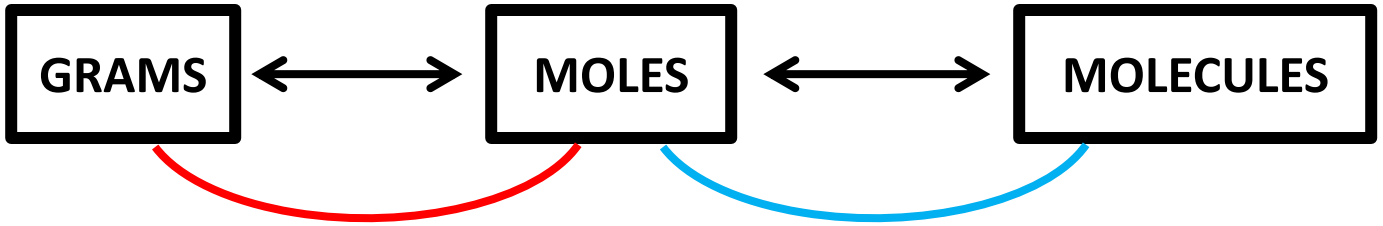
= 6.02 x 10^{23} molec./mol

"PARTICLES"	ATOMS
SODA CANS	ANYTHING!!!

REMEMBER!

You can use "particles" instead of molecules to be generic! Counting atoms? Use atoms!

Still use the number 6.02x10^{23} though!



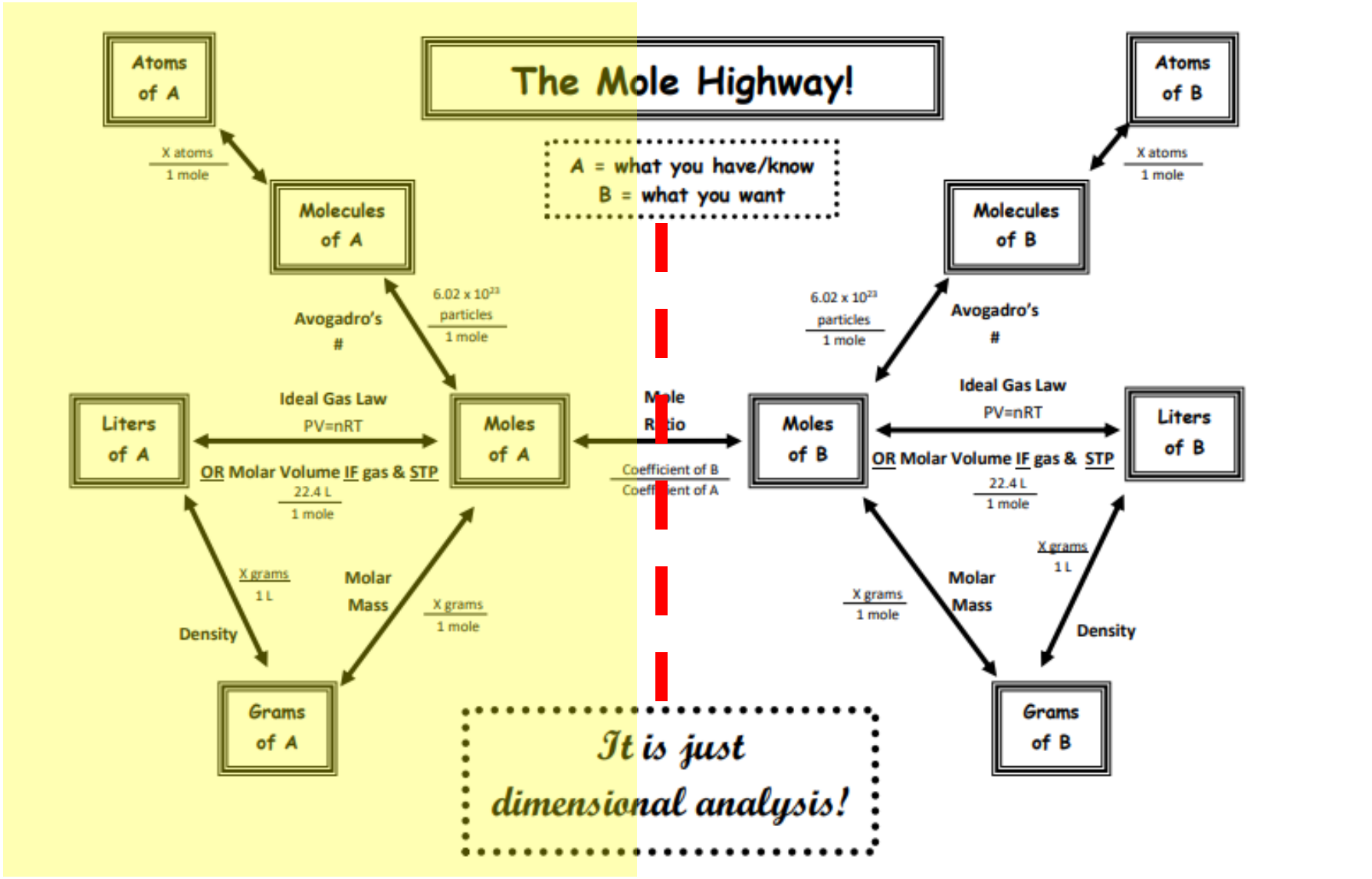
Use Molar Mass

Use Avogadro's #

= 6.02 x 10^{23} molec./mol

"PARTICLES"	ATOMS
SODA CANS	ANYTHING!!!

MOLE HIGHWAY



YouTube Link to Presentation

https://youtu.be/zrkVCPbbqeI