THE MOLE RATIO AND STOICHIOMETRY

Stoichiometry

Calculating the amounts of reactants and/or products that are involved in a reaction

How much do I have, need, or make?

STEPS

1. Know ions
2. Write formulas, cross over if needed
3. Predict products if needed
4. Balance
5. Find pathways and conversion factors
6. Dimensional analysis
7. Units!

Stoichiometry

We need a balanced equation before we can do stoichiometry.

The coefficients in the balanced equation gives insight into how much of each thing we need or make

Balanced Equation Coefficients

$$2H_2 + O_2 \rightarrow 2H_2O$$

Can be thought of as how many molecules are needed

- 2 hydrogen molecules
- 1 oxygen molecule
- 2 water molecules

Balanced Equation Coefficients

$2H_2 + O_2 \rightarrow 2H_2O$

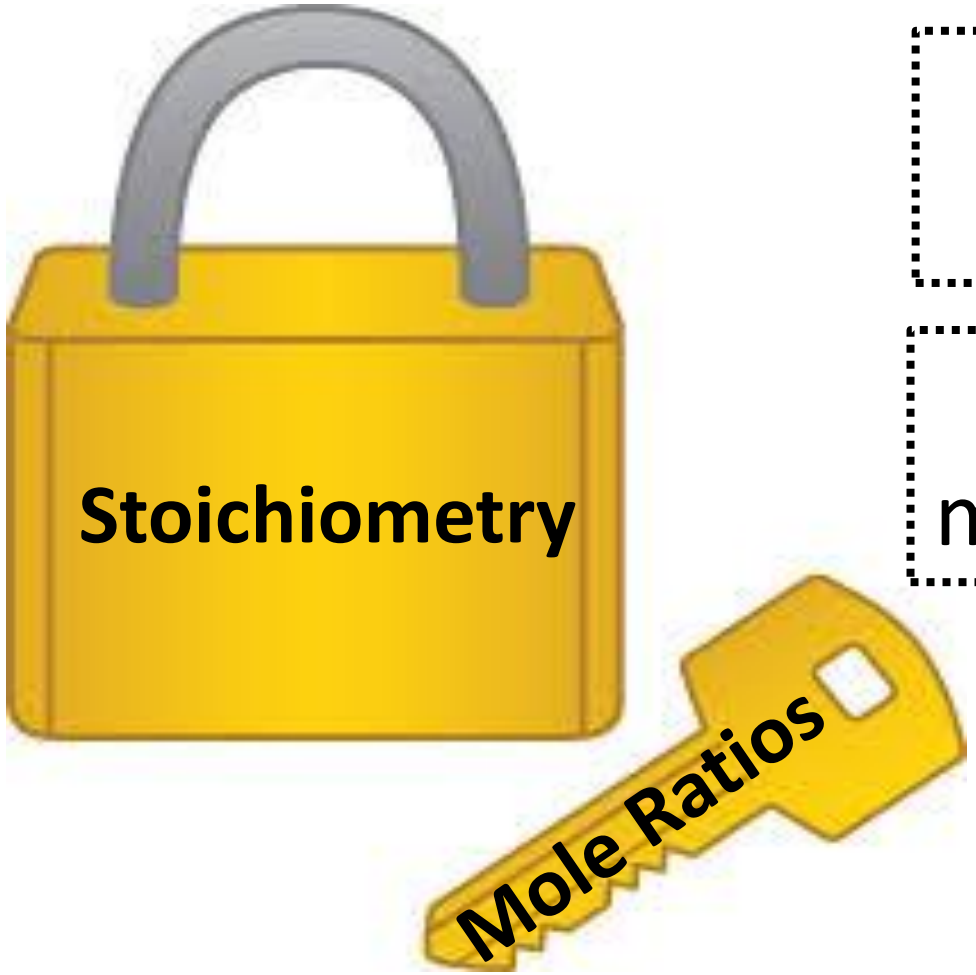
Can <u>ALSO</u> be thought of as

how many <u>MOLES</u> of molecules

- 2 ***moles*** hydrogen molecules
- 1 ***moles*** oxygen molecule
- 2 ***moles*** water molecules

Mole Ratios

The "KEY" to stoichiometry!

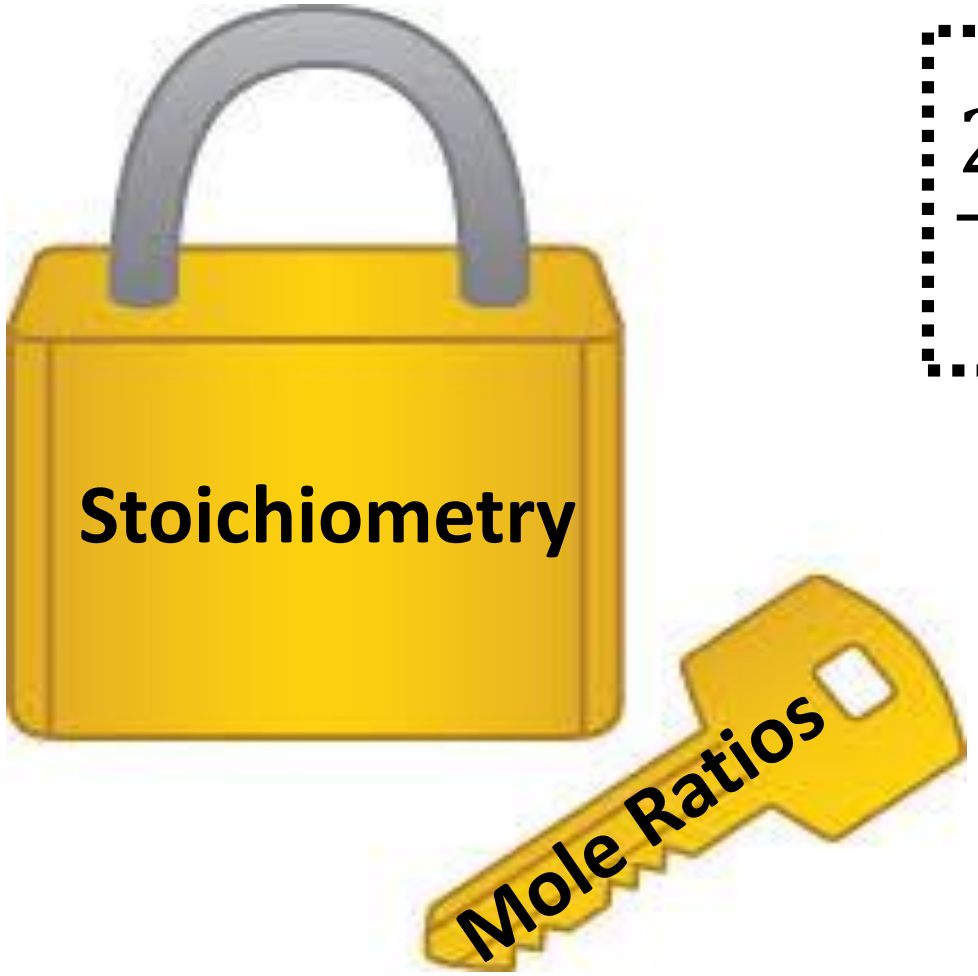


If I have 3 moles of this, how many moles of that do I have?

If I have 2 moles of this, how many moles of that can I make?

Mole Ratios

$$2H_2 + O_2 \rightarrow 2H_2O$$



$$\frac{2\ moles\ H_2}{1\ mole\ O_2}$$

$$\frac{2\ moles\ H_2}{2\ moles\ H_2O}$$

$$\frac{1\ mole\ O_2}{2\ moles\ H_2O}$$

Don't reduce your mole ratios! Leave them!

Mole Ratios

You can flip all mole ratios

$$\frac{2\ moles\ H_2}{1\ mole\ O_2}$$

$$\frac{1\ mole\ O_2}{2\ moles\ H_2}$$

$$\frac{2\ moles\ H_2}{2\ moles\ H_2O}$$

$$\frac{2\ moles\ H_2O}{2\ moles\ H_2}$$

$$\frac{1\ mole\ O_2}{2\ moles\ H_2O}$$

$$\frac{2\ moles\ H_2O}{1\ mole\ O_2}$$

Mole Ratios

Write all the mole ratios

$$2C_2H_2 + 5O_2 \rightarrow 2H_2O + 4CO_2$$

$$\frac{2\ mole\ C_2H_2}{5\ moles\ O_2}$$

$$\frac{2\ mole\ C_2H_2}{2\ moles\ H_2O}$$

$$\frac{2\ mole\ C_2H_2}{4\ moles\ CO_2}$$

$$\frac{5\ moles\ O_2}{2\ moles\ H_2O}$$

$$\frac{5\ moles\ O_2}{4\ moles\ CO_2}$$

$$\frac{2\ moles\ H_2O}{4\ moles\ CO_2}$$

You either need to…

Write the formulas into your Dimensional Analysis Line Method set up

OR

Use “A” and “B” in your Dimensional Analysis Line Method Set Up

A = known

B = unknown

Mole Ratios $2C_2H_2 + 5O_2 \rightarrow 2H_2O + 4CO_2$

Can be used as conversion factors!

How many moles of carbon dioxide can be made from 19.46 moles of oxygen gas?

$$\frac{19.46 \text{ moles } O_2}{} \left| \frac{4 \text{ moles } CO_2}{5 \text{ moles } O_2} \right. = 15.57 \text{ moles } CO_2$$

Mole Ratios $2C_2H_2 + 5O_2 \rightarrow 2H_2O + 4CO_2$

Can be used as conversion factors!

If you made 13.42 moles of water, how many moles of oxygen gas did you start with?

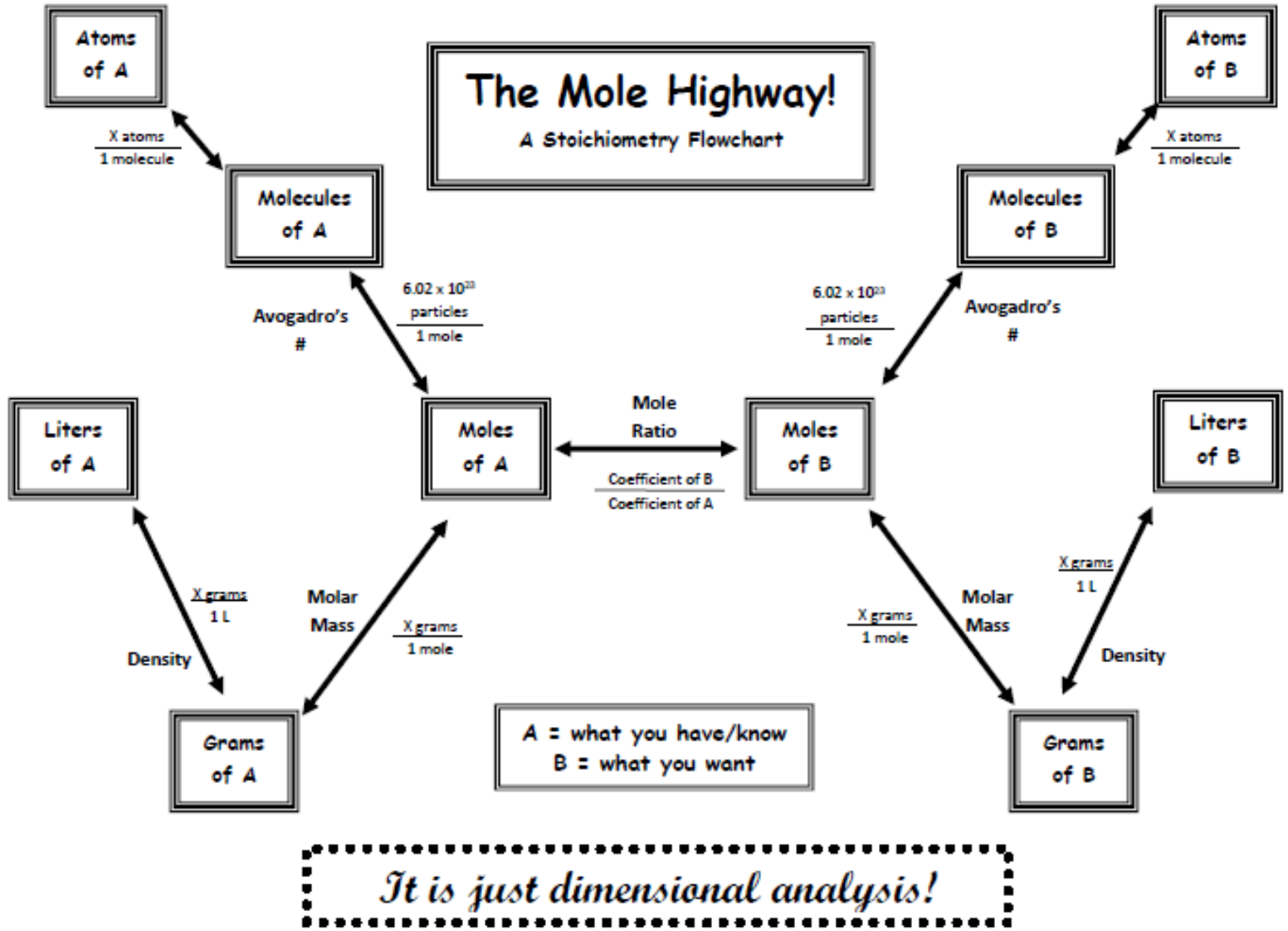
$$\frac{13.42 \text{ moles } H_2O}{} \left| \frac{5 \text{ moles } O_2}{2 \text{ moles } H_2O} \right.$$

= 33.55 moles O_2

What if you don't want your answer in moles? What if you weren't given moles?

THE MOLE HIGHWAY

All roads lead to the mole!


The Mole Highway!
A Stoichiometry Flowchart
Atoms of A
X atoms / 1 molecule
Molecules of A
Avogadro's #
6.02 x 10^23 particles / 1 mole
Moles of A
Mole Ratio
Coefficient of B / Coefficient of A
Moles of B
6.02 x 10^23 particles / 1 mole
Avogadro's #
Molecules of B
X atoms / 1 molecule
Atoms of B
Liters of A
X grams / 1 L
Density
Molar Mass
X grams / 1 mole
Grams of A
X grams / 1 mole
Molar Mass
X grams / 1 L
Density
Liters of B
Grams of B
A = what you have/know
B = what you want
It is just dimensional analysis!

YouTube link to Presentation

https://youtu.be/qz2uDkBnXtw