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?
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

2H₂ + O₂ → 2H₂O

*Can be thought of as how many molecules are needed*
- 2 hydrogen molecules
- 1 oxygen molecule
- 2 water molecules
Balanced Equation Coefficients

\[ 2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O} \]

Can **ALSO** be thought of as **how many MOLES 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

2H₂ + O₂ → 2H₂O

Stoichiometry

\[
\frac{2 \text{ moles } H₂}{1 \text{ mole } O₂} \quad \frac{2 \text{ moles } H₂}{2 \text{ moles } H₂O} \quad \frac{1 \text{ mole } O₂}{2 \text{ moles } H₂O}
\]

Don’t reduce your mole ratios! Leave them!
Mole Ratios

You can flip all mole ratios

\[
\begin{align*}
\frac{2 \text{ moles } H_2}{1 \text{ mole } O_2} & \quad \frac{2 \text{ moles } H_2}{2 \text{ moles } H_2O} & \quad \frac{1 \text{ mole } O_2}{2 \text{ moles } H_2O} \\
\frac{1 \text{ mole } O_2}{2 \text{ moles } H_2} & \quad \frac{2 \text{ moles } H_2O}{2 \text{ moles } H_2} & \quad \frac{2 \text{ moles } H_2O}{1 \text{ mole } O_2}
\end{align*}
\]
Mole Ratios

Write all the mole ratios

\[ 2\text{C}_2\text{H}_2 + 5\text{O}_2 \rightarrow 2\text{H}_2\text{O} + 4\text{CO}_2 \]

\[
\frac{2 \text{ mole } \text{C}_2\text{H}_2}{5 \text{ moles } \text{O}_2} \quad \frac{2 \text{ mole } \text{C}_2\text{H}_2}{2 \text{ moles } \text{H}_2\text{O}} \quad \frac{2 \text{ mole } \text{C}_2\text{H}_2}{4 \text{ moles } \text{CO}_2} \\
\frac{5 \text{ moles } \text{O}_2}{2 \text{ moles } \text{H}_2\text{O}} \quad \frac{5 \text{ moles } \text{O}_2}{4 \text{ moles } \text{CO}_2} \quad \frac{2 \text{ moles } \text{H}_2\text{O}}{4 \text{ moles } \text{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

\[ A = \text{known} \]

\[ B = \text{unknown} \]
Mole Ratios $2\text{C}_2\text{H}_2 + 5\text{O}_2 \rightarrow 2\text{H}_2\text{O} + 4\text{CO}_2$

*Can be used as conversion factors!*

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

\[
\frac{19.46 \text{ moles O}_2}{5 \text{ moles O}_2} \times 4 \text{ moles CO}_2 = 15.57 \text{ moles CO}_2
\]
**Mole Ratios** \( 2\text{C}_2\text{H}_2 + 5\text{O}_2 \rightarrow 2\text{H}_2\text{O} + 4\text{CO}_2 \)

*Can be used as conversion factors!*

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

\[
\begin{array}{c|c|c}
13.42 \text{ moles H}_2\text{O} & 5 \text{ moles O}_2 & = 33.55 \text{ moles O}_2 \\
2 \text{ moles H}_2\text{O} & & \\
\end{array}
\]
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

Molecules of A

Liters of A

Moles of A

Grams of A

Molar Mass

Density

Atoms of B

Molecules of B

Liters of B

Moles of B

Grams of B

Mole Ratio

Coefficient of A

X grams

1 mole

Avogadro's #

6.02 x 10^23 particles

1 mole

5.02 x 10^23 particles

1 mole

Avogadro's #

X grams

1 mole

X grams

1 mole

X grams

1 mole

X grams

1 mole

A = what you have/know
B = what you want

It is just dimensional analysis!