<u>N26 – THE MOLE RATIO AND</u> <u>Stoichiometry</u>

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

How much do I have, need, or make?

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

Why use Molar Coefficients and not Grams for our calculations? Allows us to compare "apples to apples"





Mole Ratios

Stoichiometry

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

Can be used as conversion factors!

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



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?



<u>What if you don't want</u> <u>your answer in moles?</u> What if you weren't given moles?

THE MOLE HIGHWAY All roads lead to the mole!





<u>Guided Stoichiometry</u> <u>Practice Problems</u>



 $N_2 + 3H_2 \rightarrow 2NH_3$

54 grams $N_2 \rightarrow$? moles NH_3

Pathway: grams $A \rightarrow moles A \rightarrow moles B$

Molar mass of A <u>X g A</u> 1 mole A Mole Ratio <u>moles B</u> moles A





 $N_2 + 3H_2 \rightarrow 2NH_3$

75 grams $NH_3 \rightarrow ?gH_2$

Pathway:

grams $A \rightarrow$ moles $A \rightarrow$ moles $B \rightarrow$ grams B

Molar	Mole Ratio	Molar
mass of A	<u>moles B</u>	mass of B
<u>X g A</u>	moles A	<u>X g B</u>
1 mole A		1 mole B



LOTS of possible routes!

- Just follow the mole highway
- Use dimensional analysis
- Flip conversion factors
- Cancel units



Things don't always work perfectly...

In the lab sometimes you don't make 100% of what your stoichiometry calculation says you should make

SOMETIMES I LIE AWAKE AT NIGHT, AND I ASK, "WHERE HAVE I GONE WRONG?" THEN A VOICE SAYS TO ME, "THIS IS GOING TO TAKE MORE THAN ONE NIGHT."

Theoretical Yield

The quantities that the stoichiometry calculations predict *should* be made

<u>Actual Yield</u>

The quantity that you <u>actually</u> made in the lab experiment

<u>% Yield</u>

The quantity that you <u>actually</u> made in the lab experiment

percent yield =
$$\frac{\text{actual yield}}{\text{theoretical yield}} \times 100\%$$