HONORS CHEMISTRY: INTRODUCTION TO STOICHIOMETRY DATE:_____

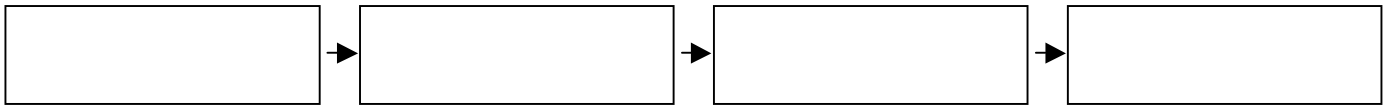
Learning Goals: **SWBAT. . .**

…define and explain the purpose of stoichiometry.
…review mole ratio and molar mass problems.

STOICHIOMETRY:

- Uses _____ and _____ in factor-label framework.
- Answers questions such as, "How much reactant do I need?" or "How much product will I produce here?"
- 95% of stoichiometry is done without a calculator so PLAN, THINK & CHECK!

BASIC IDEA: Usually want to determine the mass of something needed or produced in a chemical reaction given the mass of something else. Not easy to do in one step, but is very doable in multiple steps:



- To go from grams to moles (or vice-versa) you'll use a molar mass conversion (one step)
- To go from moles to moles you'll use a mole ratio conversion (one step)

REVIEWING MOLAR MASS CONVERSIONS:

Needed for most problems because you'll have to convert from mass to moles and vice-versa.

Try these:

1) 57.8 grams of water is how many moles of water?

2) 2.00 moles of $CaCO_3$ has what mass?

REVIEWING MOLE RATIO CONVERSIONS:

Each problem requires a balanced chemical equation and with it we have the relative moles of each chemical.

- This is when the unit 'mole' can have a number greater than '1' in front of it.

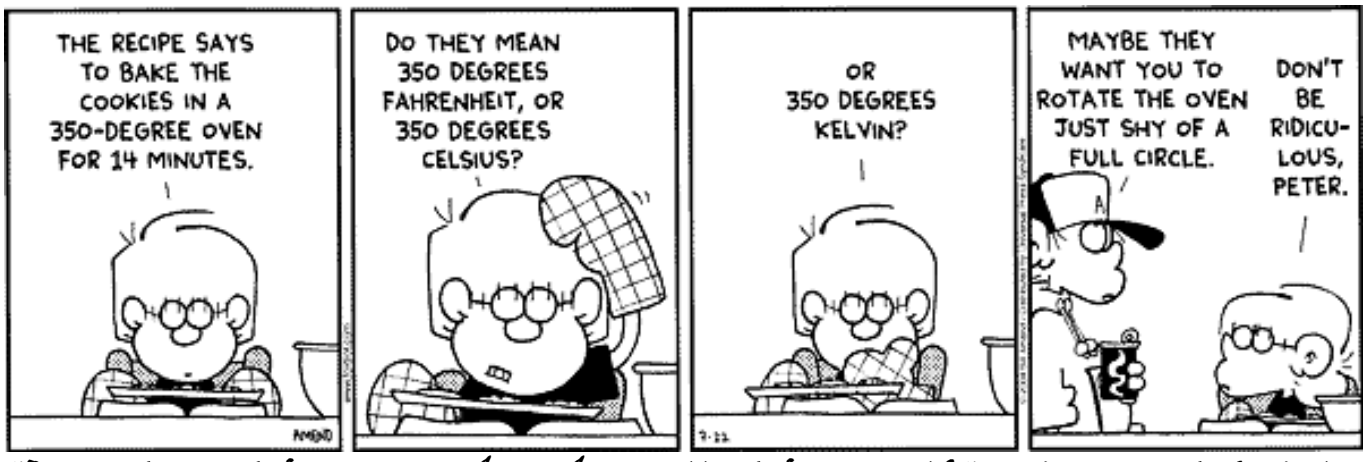
Try these:

1) Balance this and determine the mole ratio: $NH_3(g) + O_2(g) \rightarrow NO(g) + H_2O(l)$

2) IF you have 12 moles of ammonia, how many moles of diatomic oxygen would you need to consume to react it completely? How many moles of each product would you produce?

ANOTHER TAKE ON THIS

REVIEW & REFLECTION



"Be patient with everyone, but above all with yourself." ~ St. Francis de Sales

HONORS CHEMISTRY
STOICHIOMETRY BASICS

NAME _____

1. Set up generic factor-label problems to convert each of these units to moles:

GRAMS, POUNDS, ATOMS, AMUS, MILLILITERS

2. How many moles of oxygen are in 5.5 moles of sodium bicarbonate?

3. Write out a balanced equation for the complete combustion of methane (CH_4). How many moles of atmospheric oxygen would be needed to burn 2.8 moles of methane?

"Perfect as the wing of a bird may be, it will never enable the bird to fly if unsupported by the air. Facts are the air of science. Without them a man of science can never rise."
- Ivan Pavlov

HONORS CHEMISTRY: YOU TOO CAN DO STOICHIOMETRY! DATE:_____

Learning Goals: **SWBAT. . .**
…work through an entire stoichiometry problem.

STEP-BY-STEP STOICHIOMETRY:

1. **Summarize the relevant information.**
2. **Balance the equation and determine the mole ratio.**
3. **Determine any required molar masses. (steps 2 & 3 can be done in either order)**
4. **Determine the appropriate factor-label conversions and set up the problem.**
5. **Estimate the answer. Do the math and double-check your work.**

Try this: How many grams of sodium hydroxide will you produce from the reaction of 250.0 grams of sodium metal and water? Unbalanced equation = **$Na(s) + H_2O(l) \rightarrow NaOH(aq) + H_2(g)$**

1. Relevant information:

2. Balance equation:

Mole ratio:

3. Find molar masses:

4. Set-up factor label:

Using this information we could also solve for the amount of water consumed and hydrogen produced:

Try this: Potassium chlorate decomposes into potassium chloride and oxygen gas. Determine how much of each product is formed (in grams) if you start with 75.0 grams of potassium chlorate. Be sure to check your work using the Law of Conservation of Mass.

CRASH COURSE THIS

REVIEW & REFLECTION

"It is easier not to begin to go wrong than it is to turn back and do better after beginning."
~ James A. Garfield

HONORS CHEMISTRY NAME _____

MORE STOICHIOMETRY PRACTICE

The average human requires 120.0 grams of glucose ($C_6H_{12}O_6$) per day. How many grams of CO_2 (in the photosynthesis reaction) are required for this amount of glucose?

The unbalanced photosynthetic reaction is: CO_2 + H_2O ---> $C_6H_{12}O_6$ + O_2

"I have discovered that all human evil comes from this, man's being unable to sit still in a room." - Blaise Pascal

HONORS CHEMISTRY: LIMITING REACTANTS DATE:_____

Learning Goals: **SWBAT. . .**

…identify the limiting and excess reactants in a chemical reaction.
…calculate the final amounts of all reactants and products.

LIFE IS NOT PERFECT.

In an ideal chemical reaction…

In the real world…

- We need to be able to identify these and determine how much product is formed.

LIMITING REACTANT/REAGENT:

EXCESS REACTANT/REAGENT:

HOW TO DETERMINE THE LIMITING REACTANT:

1. These problems can be identified easily, since you must be given the mass of multiple reactants.
2. Set up a stoichiometry problem for each potential limiting reactant. Solve for a common product.
3. Whichever one produces the least is the limiting reactant. The other product calculations can be ignored.
4. Use the limiting reactant to determine how much of the other chemicals are consumed/produced.

Try this: The combustion of hydrogen gas produces water vapor. Given 100.0 grams of each reactant, determine which is the limiting reactant and how much water will be produced.

Show how many grams of each chemical are present before and after the reaction.

ANOTHER TAKE ON THIS

"If I must choose the lesser of two evils, I will choose neither."~ Karl Krause

HONORS CHEMISTRY: PERCENT YIELDS

DATE:_____

Objectives: **Learning goals. . .**

…determine the actual and theoretical yields of a chemical reaction.

IN CHEMISTRY, AS IN LIFE, YOU DON'T ALWAYS GET EVERYTHING YOU THINK YOU WILL.

THEORETICAL YIELD:

ACTUAL YIELD:

The only way to determine this is…

Two reasons why actual yields don't often reach the theoretical yields:

-

-

An important skill for a chemist is…

$$\textbf{Percent yield} = \frac{\textbf{actual yield}}{\textbf{theoretical yield}} \times 100\%$$

Try this: A typical aspirin synthesis produces 96.0 g $C_9H_8O_4$ of a predicted 261 g. What's the percent yield?

Try this: a reaction should yield 2.205g of NaCl, but produces only 2.100g. What is the percent yield?

A LITTLE REVIEW, A LITTLE NEW

REVIEW & REFLECTION

If I meet a hundred-year-old man and I have something to teach him, I will teach; if I meet an eight-year-old boy and he has something to teach me, I will learn."

~ Chao-Chou

HONORS CHEMISTRY
LIMITING REACTANTS

NAME _____

Consider the following balanced equation:

$$C_6H_6 + Br_2 \rightarrow C_6H_5Br + HBr$$

What is the theoretical yield of C_6H_5Br if 42.1 g of C_6H_6 react with 73.0 g of Br_2?

If the actual yield of C_6H_5Br is 63.6 g, what is the percent yield?

Consider the following unbalanced reaction:

$$NH_4NO_3 + Na_3PO_4 \rightarrow (NH_4)_3PO_4 + NaNO_3$$

Which reactant is limiting, assuming we started with 30.0 grams of ammonium nitrate and 50.0 grams of sodium phosphate. What is the mass of each product that can be formed? What mass of the excess reactant(s) is left over?

If the actual yield of sodium nitrate is 15.0 grams, what is the percent yield?

"Why is this thus? What is the reason for this thusness?" - Artemus Ward