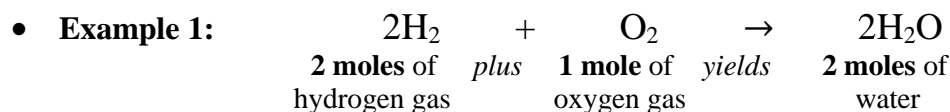


## Using Equations

- Chemists use balanced chemical equations as a basis to calculate how much reactant is needed or how much product will be formed in a reaction.
  - *Knowing one quantity allows you to calculate another!*
  - *Stoichiometry is the process of calculating quantities in chemical reactions!*
- A balanced chemical equation can be interpreted in terms of different quantities:
  - Number of atoms
  - Number of molecules
  - Moles
  - Mass
  - Volume

## Stoichiometric Calculations

- Identifying the mole ratio, *a conversion factor derived from the coefficients of a balanced chemical equation*, will be essential to switch between substances!



- If you had 3.75 moles of hydrogen gas and an excess of oxygen gas, how many moles of water would be produced?
- If you had 2.25 moles of hydrogen gas and an excess of oxygen gas, how many grams of water would be produced?
- If 45.0 g of water was produced, how many moles of oxygen gas reacted?
- If 10.0 g of water was produced at STP, how many liters of oxygen reacted?



- If you start with 200.0 grams of sodium hydroxide, how many grams of the aqueous product will be formed?
- If you start with 50.5 grams of sulfuric acid, how many molecules of water are formed?



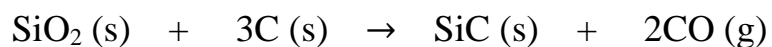
- If you start with 35.0 grams of the hydrocarbon, how many moles of the water will be formed?
- If you start with 45.0 grams of oxygen, how many liters of carbon dioxide are formed?

## Yields

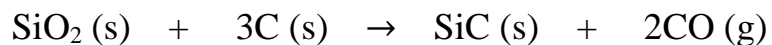
- **Actual Yield:**
- **Theoretical Yield:**
- **Percent Yield:**
- **Example 1:** What is the percent yield of the reaction in which 24.8 g of calcium carbonate is decomposed to form 13.1 g of calcium oxide?

- **Example 2:** What is the percent yield of the reaction in which 4.70 g of silver (I) chloride is produced when 4.61 g of silver (I) carbonate reacts with excess hydrochloric acid?

- **Example 3:** When silicon dioxide combines with carbon in the following reaction, it is only 95.2 % efficient. What mass of silicon carbide will form when 5.75 g of silicon dioxide reacts?



- **Example 4:** When silicon dioxide combines with carbon in the following reaction, it is only 95.2 % efficient. If a chemist wants to prepare 30.0 grams of silicon monocarbide, what mass of carbon should be used?



## Limiting & Excess Reactants (Reagents)

- **Limiting Reactant**

- The reactant that is completely \_\_\_\_\_ in the reaction.
- \_\_\_\_\_ how much \_\_\_\_\_ is formed.

- **Excess Reactant**

- The reactant that is NOT \_\_\_\_\_ in the reaction.
- Is \_\_\_\_\_ in excess.

- **PROBLEM SOLVING TIP:**

*If **2 VALUES** are given for **REACTANTS** you must use the following steps to identify the **Limiting & Excess Reactant** before continuing the problem!*

1. Pick a product. It can be any one, but pick the one the problem mentions if possible. Stick with it.
  2. Use one reactant to determine how much of that product you'd make.
  3. Use the other reactant(s) to determine how much of that **same** product you'd make.
  4. Compare. Whichever reactant led to **less product** is the **limiting reagent**. The amount of product produced by the limiting reagent is your **theoretical yield**.
  5. Use the theoretical yield to determine how much **excess reagent** was used up in the reaction. Subtract this from the initial amount of excess reagent (given) to find **how much excess reagent remains** after the reaction has stopped.
  6. If necessary, use the limiting reagent to calculate percent yield.
- See "**Limiting Reagent Sample Problem**" worksheet for step-by-step examples