

Limiting Reagent and Percent Yield

Definition

When will a chemical reaction stop?

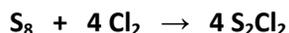
limiting reagent (or limiting reactant)

excess reagent (or excess reactant)

Previous calculations were based solely on the ratios of one compound to all of the other compounds according to the balanced chemical equation. Now you must identify the limiting reagent of the reaction before being able to determine how much of a reactant is used or how much product is formed.

Calculating Limiting Reagent

Consider the following reaction if 200.0 g of sulfur reacts with 100.0 g of chlorine:



Question 1:

What is the limiting reactant?

Method 1

1. Convert both reactants to moles, if necessary.
2. Compare mole ratios from the chemical equation to mole ratios from the conversions.
3. Find which reactant is available in a ratio smaller than needed. This is the limiting reactant.

Method 2

1. Convert both reactants to moles, if necessary.
2. Convert moles of each reactant to moles (or mass) of product.
3. Whichever produces the least product is the limiting reactant.

Question 2

What mass of S_2Cl_4 is produced?

Question 3

How much excess reactant remains?

Summary

These are two of the most common methods of finding the limiting reagent of a reaction. You may choose to use either of these methods as long as you show work and solve for the correct number of significant figures!

Practice

If 90.0 g of FeCl_3 reacts with 52.0 g of H_2S according to the provided reaction, answer the following questions.



1. What is the limiting reactant?
2. What is the mass of hydrochloric acid produced?
3. What mass of excess reactant remains after the reaction?

Percent Yield

Define the following:

theoretical yield

actual yield

percent yield

Percent yield is given by the following equation:

$$\text{Percent yield} = \frac{\text{actual yield}}{\text{theoretical yield}} (100)$$

Example

If 39.3 g of Fe_2S_3 are actually produced in the example used for calculating limiting reagent, what is the percent yield?

Theoretical

_____ mol Fe_2S_3 = _____ g Fe_2S_3

Percent Yield