Percent Yield & Limiting Reactant

Our Goals for the Day

Reactants ⇒ Products

- 2 Questions to Answer...
  - How much product should a reaction create?
  - At what point will a reaction end?

Percent Yield & Limiting Reactant

Percent Yield

- Percentage Yield
  - A ratio comparing the actual amount of product to the amount that should be produced

$$\% \text{ Yield} = \frac{\text{Actual Yield}}{\text{Theoretical Yield}} \times 100$$

- Actual = from experimentation
- Theoretical = predicted by mass/mass problem

Percent Yield & Limiting Reactant

Percent Yield

- Steps:
  - 1. Write a balanced equation
  - 2. Start with a reactant mass
  - 3. Set goal at mass of known product
  - 4. Solve mass-mass problem
  - 5. Use result of mass-mass problem as theoretical yield in % yield equation

Percent Yield & Limiting Reactant

Percent Yield

- When 15.5 grams of CH_4 is combusted with excess oxygen, 32.1 grams of water is collected. What is the percent yield?

$$\underset{15.5g\ CH_4}{CH_4} + 2O_2 \Rightarrow CO_2 + \underset{32.1g\ H_2O}{2H_2O}$$

$$\frac{1\ mol\ CH_4}{16.0g\ CH_4} \times \frac{2\ mol\ H_2O}{1\ mol\ CH_4} \times \frac{18.0g\ H_2O}{1\ mol\ H_2O} = 34.9\ g\ H_2O$$

$$\%\ Yield = \frac{actual}{theor} \times 100 = \frac{\quad}{\quad} \times 100 = 92.0\%$$

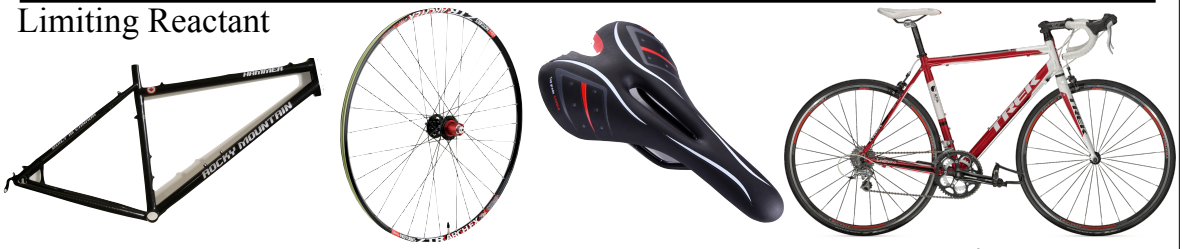
Percent Yield & Limiting Reactant

Limiting Reactant

- Limiting Reactant
  - A limiting reactant is the reactant that is completely consumed in a chemical reaction
  - It limits the extent to which the reaction proceeds

Percent Yield & Limiting Reactant

Limiting Reactant



$$1F + 2W + 1S \Rightarrow Bi$$

120 lbs	100 lbs	50 lbs	
÷20 lbs/frame	÷10 lbs/wheel	÷2 lbs/seat	Account for Mass
6 Frames	10 Wheels	25 Seats	
÷	÷	÷	Account for Ratio
6 Frames	5 Wheels	25 Seats	

Limiting Reactant

Percent Yield & Limiting Reactant

Limiting Reactant

- Limiting Reactant
  - Steps:
    - 1. Balanced Equation
    - 2. Convert mass to moles (account for mass)
    - 3. Divide by coefficients (account for ratio)
    - 4. Smallest is limiting

Percent Yield & Limiting Reactant

Limiting Reactant

- 25.0 grams HCl reacts with 25.0 grams of zinc to form zinc chloride and hydrogen gas. Which is the limiting reactant?

$$2HCl + Zn \Rightarrow ZnCl_2 + H_2$$

$$\frac{25.0g\ HCl \mid 1\ mol\ HCl}{\mid 36.5g\ HCl} = 0.685\ mol\ HCl \div 2 = 0.343\ mol\ HCl$$

HCl is the Limiting Reactant

$$\frac{25.0g\ Zn \mid 1\ mol\ Zn}{\mid 65.4g\ Zn} = 0.382\ mol\ Zn \div 1 = 0.382\ mol\ Zn$$