

PRACTICE

What is the limiting reactant when 25.0 mole of iron (III) oxide reacts with 30.0 moles of carbon monoxide?



$$25.0 \text{ mol Fe}_2\text{O}_3 \times \frac{3 \text{ mol CO}}{1 \text{ mol Fe}_2\text{O}_3} = 75.0 \text{ mol CO} \quad \begin{array}{l} \text{need} \\ \text{LR} \end{array} \quad \begin{array}{l} \text{have} \\ 30.0 \text{ mol CO} \end{array}$$

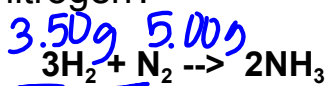
$$30.0 \text{ mol CO} \times \frac{1 \text{ mol Fe}_2\text{O}_3}{3 \text{ mol CO}} = 10.0 \text{ mol Fe}_2\text{O}_3 \quad \begin{array}{l} \text{XS} \\ 25.0 \text{ mol Fe}_2\text{O}_3 \end{array}$$

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PRACTICE

H₂ - XS
N₂ - LR

What is the limiting reactant if 3.50 grams of hydrogen reacts with 5.00 grams of nitrogen?



$$3.50 \text{ g H}_2 \times \frac{1 \text{ mol H}_2}{2 \text{ g H}_2} \times \frac{1 \text{ mol N}_2}{3 \text{ mol H}_2} \times \frac{28 \text{ g N}_2}{1 \text{ mol N}_2} = 16.3 \text{ g N}_2 \quad \begin{array}{l} \text{need} \end{array}$$

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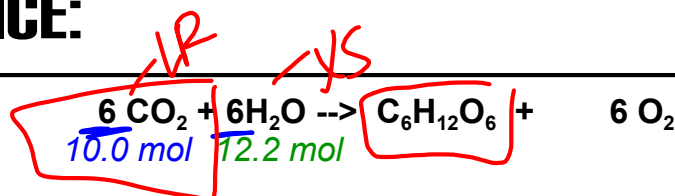
HOW MUCH PRODUCT IS FORMED?

To find the amount of product formed:

- Start your calculation with the amount of the limiting reactant given in the problem
- Limiting reactants always determine the amount of product formed.

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PRACTICE:



a. What is the limiting reactant?

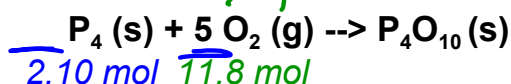
$$10.0 \text{ mol CO}_2 \times \frac{6 \text{ mol H}_2\text{O}}{6 \text{ mol CO}_2} = 10.0 \text{ mol H}_2\text{O}$$

need have
12.2 mol H₂O
2.2 mol H₂O in XS

b. How many moles of glucose will be produced by this reaction?

$$10.0 \text{ mol CO}_2 \times \frac{1 \text{ mol C}_6\text{H}_{12}\text{O}_6}{6 \text{ mol CO}_2} = 1.67 \text{ mol C}_6\text{H}_{12}\text{O}_6$$

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PRACTICE:

a. What is the limiting reactant?

$$2.10 \text{ mol } P_4 \times \frac{5 \text{ mol } O_2}{1 \text{ mol } P_4} = 10.5 \text{ mol } O_2 \quad \begin{array}{l} \text{need} \\ \hline 11.8 \text{ mol } O_2 \\ \text{have} \end{array}$$

b. How many grams of P_4O_{10} will be produced by this reaction?

$$2.10 \text{ mol } P_4 \times \frac{1 \text{ mol } P_4O_{10}}{1 \text{ mol } P_4} \times \frac{284 \text{ g } P_4O_{10}}{1 \text{ mol } P_4O_{10}} = 596 \text{ g } P_4O_{10}$$

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Percent Yield:

- Not all chemical reactions go smoothly or as planned
- Because of this, we have a mathematical way to calculate the efficiency of a reaction.

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Percent Yield:

Actual Yield: the amount that you end up with in the lab (what is actually produced)

↖ lab data

Theoretical Yield: the amount that you *could* end up with (calculated amount)

↖ stoch

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Percent Yield:

Equation:

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

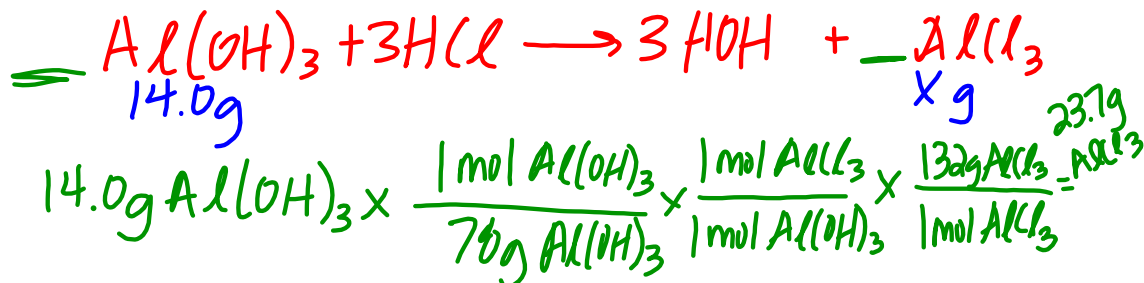
↖ from Lab

↖ from calculations (stoch)

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Practice:

Antacids often contain aluminum hydroxide to neutralize stomach acid (HCl). If a tablet contains 14.0g of aluminum hydroxide, determine the theoretical yield of AlCl_3 produced in the reaction with stomach acid.



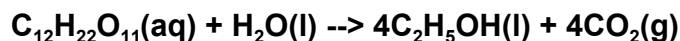
If the actual yield of aluminum chloride is 22.0 g, what is the percent yield?

$$\frac{22.0\text{g AlCl}_3}{23.7\text{g AlCl}_3} \times 100 = 92.8\%$$

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Practice:

Ethanol ($\text{C}_2\text{H}_5\text{OH}$) is produced from the fermentation of sucrose in the presence of enzymes. Determine the theoretical and percent yields of ethanol if 684 g of sucrose undergoes fermentation and 349 g of ethanol is obtained.



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