Announcements

Monday, March 23, 2009

Quiz 2 average around 11/15. If you got well under 10, you have some real work to do!

MasteringChemistry assignments:

- Ch 7 due this Wed, Mar 25
- Ch 8 due next Mon, Mar 30
- Ch 9 due next Wed, Apr 1 (will be available tomorrow)

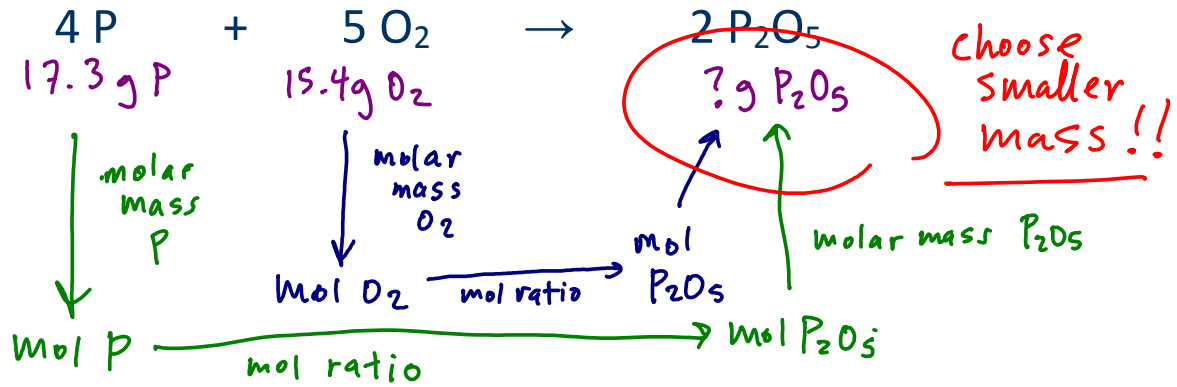
Exam 2 covering the end of Ch 5 through Ch 9 will be next Wed, April 1. The study guide will be available by noon tomorrow (email me if it's not!).

Exp 4 this week.

Discussion assignment 2 will be in D2L tomorrow. We will discuss it Wednesday.

What if you're given masses of two reactants and are asked for product mass?

17.3 g P are reacted with 15.4 g O_2. How many grams P_2O_5 can be produced?



This is a **limiting reactant** problem:

- One reactant is consumed before the other
- Once one reactant is consumed, the reaction stops!
- The reactant that's consumed first is the limiting reactant

$$17.3\text{g P} \times \frac{1\text{ mol P}}{30.97\text{ g P}} \times \frac{2\text{ mol } P_2O_5}{4\text{ mol P}} \times \frac{141.94\text{ g } P_2O_5}{1\text{ mol } P_2O_5} = 39.0\text{ g } P_2O_5$$ (cannot be formed)

$$15.4\text{ g } O_2 \times \frac{1\text{ mol } O_2}{32.00\text{ g } O_2} \times \frac{2\text{ mol } P_2O_5}{5\text{ mol } O_2} \times \frac{141.94\text{ g } P_2O_5}{1\text{ mol } P_2O_5} = 27.3\text{ g } P_2O_5$$ (can be produced) — theoretical yield

O_2 runs out first because it can only produce 27.3 g product. → that's when the reaction stops!

(O_2 is the limiting reactant)

answer: 27.3g product can be formed.

Theoretical yield: product mass from a stoichiometry calculation. Maximum amount of product that can be formed under ideal conditions.

27.3 g P_2O_5 = theoretical yield

(the limiting reactant is the reactant that forms the theo. yield of pdt)

Actual yield: isolated product mass from real reaction in a real lab. Always smaller than theoretical yield.

will be given in the question

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

Say the actual yield of the previous reaction was 25.2 g P_2O_5. What was the percent yield?

$\frac{25.2\text{ g}}{27.3\text{ g}} \times 100\% =$ 92.3% yield

Limiting reactant practice

If 4.20 g Ca reacted with 2.80 g O_2, what is the theoretical yield of CaO? Which is the limiting reactant? What was the % yield if 4.93 g CaO were produced?

$$2\ Ca(s) + O_2(g) \longrightarrow 2\ CaO(s)$$

$$\underset{\text{lim. reactant}}{4.20\text{ g Ca}} \times \frac{1\text{ mol Ca}}{40.08\text{ g Ca}} \times \frac{2\text{ mol CaO}}{2\text{ mol Ca}} \times \frac{56.08\text{ g CaO}}{1\text{ mol CaO}} = \boxed{5.88\text{ g CaO}}$$ theo. yield

$$2.80\text{ g } O_2 \times \frac{1\text{ mol } O_2}{32.00\text{ g } O_2} \times \frac{2\text{ mol CaO}}{1\text{ mol } O_2} \times \frac{56.08\text{ g CaO}}{1\text{ mol CaO}} = 9.81\text{ g CaO}$$

$$\%\text{ yield} = \frac{4.93\text{ g}}{5.88\text{ g}} \times 100\% = \boxed{83.8\%}$$

If 12.3 g Na react with 0.750 g H_2, what is the theoretical yield of NaH? Which is the limiting reactant? If 8.24 g NaH were produced, what was the % yield?

$$2\ Na + H_2 \longrightarrow 2\ NaH$$

$$\underset{\text{limiting reactant}}{12.3\text{ g Na}} \times \frac{1\text{ mol Na}}{22.99\text{ g Na}} \times \frac{2\text{ mol NaH}}{2\text{ mol Na}} \times \frac{23.998\text{ g NaH}}{1\text{ mol NaH}} = \boxed{12.8\text{ g NaH}}$$ theoretical yield

$$0.750\text{ g } H_2 \times \frac{1\text{ mol } H_2}{2.016\text{ g } H_2} \times \frac{2\text{ mol NaH}}{1\text{ mol } H_2} \times \frac{23.998\text{ g NaH}}{1\text{ mol NaH}} = 17.9\text{ g NaH}$$ not produced

$$\%\text{ yield} = \frac{8.24\text{ g}}{12.8\text{ g}} \times 100\% = \boxed{64.4\%}$$