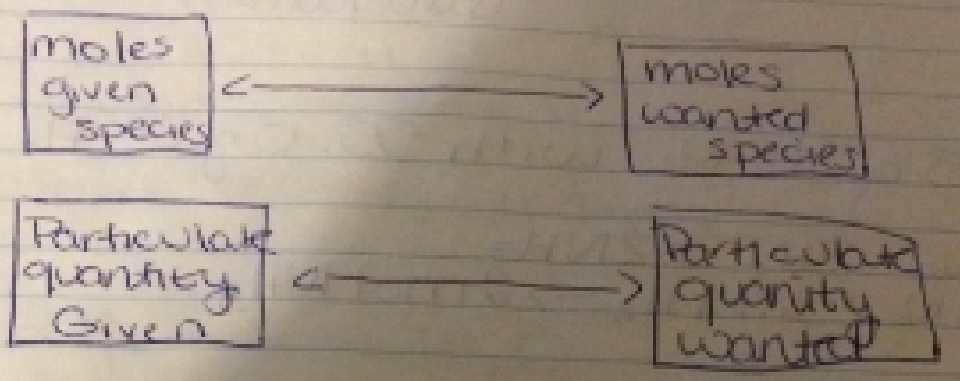
Chapter 10:

Stoichiometry

7/15/14



Comparison of Moles Method:

0. make sure you have a balanced equation; showing all products + reactants

1. Convert the # of grams of each reactant to moles.

2. identify limited reactant

a. Calculate # of moles of each species that reacts or is produced.

b. Calculate # of moles

c.

equation:

amount of B supplied − amount of B needed (from calculation) = (+) or (−)

ex: 55 g of N_2 with 55.0 g of H_2

$N_2 + 3H_2 \rightarrow 2NH_3$

$1\,mol\,N_2 + 3\,mol\,H_2 \rightarrow 2\,mol\,NH_3$

$\frac{3\,mol\,H_2}{1\,mol\,N_2}$ $\frac{3\,mol\,H_2}{2\,mol\,NH_3}$ $\frac{2\,mol\,NH_3}{1\,mol\,N_2}$

$55.0\,g\,N_2 \times \frac{1\,mole\,N_2}{28.02\,g\,N_2} = 1.96\,mol\,N_2$

$55.0\,g\,H_2 \times \frac{1\,mole\,H_2}{2.02\,g\,H_2} = 27.2\,mole\,H_2$

N_2 = "A"

Given: N_2 $\frac{1.96\,mol\,N_2}{1} \times \frac{3\,mol\,H_2}{1\,mol\,N_2} = 5.88\,mol$

$An = 27.2\,mol\,H_2 - 5.88\,mol\,H_2 = 21.32\,mol$

N_2 is the limited reagent

$CaCO_3 \rightarrow CaO +$

$AgNO_3$

$1.96 mol\ N_2 \times \frac{2 mol\ NH_3}{1 mol} = 3.92 mol\ NH_3$

$3.92 mol\ NH_3 \times \frac{17.03 g}{mol\ NH_3} = 66.644 g\ NH_3$

H_2 used: $5.88 mol\ H_2 \times \frac{2.02}{mol\ H_2} = 11.9 g\ H_2$

leftover: $95 g\ H_2 - 11.9 g\ H_2 = 43.1 g\ H_2$

$2 H_2 + O_2 \rightarrow 2 H_2O$

$H_2 = 64g$
$O_2 = 32g$

$64 g\ H_2 \frac{1 mol\ H_2}{2 g\ H_2} = 32 mol\ H_2$ can be made

$32 g\ O_2 \frac{1 mol\ O_2}{32 g\ O_2} = 1 mol\ O_2$

mole ratios:

$\frac{2 mol\ H_2}{1 mol\ O_2}$ $\frac{2 mol\ H_2}{2 mol\ H_2O}$ 2 mol of H_2O can be made.

Given 5 g of CH_4 and 32.0 g O_2, which is limiting reagent?

$CH_4 + O_2 \rightarrow CO_2 + H_2O$

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ balanced

molar mass $CH_4 = 1 \times 12.0 \frac{g\ C}{mol} + 4 \times 1.01 \frac{g\ H}{mol} = 16.04 \frac{g}{mol\ CH_4}$

$O_2 = 2 \times 16.0 \frac{g}{mol} = 32.0 g/mol$